GOVERNMENT OF MADRAS

FOOD AND AGRICULTURE DEPARTMENT

REPORT ON AGRICULTURAL RESEARCH IN THE MADRAS PROVINCE

BY

THE EXPERT COMMITTEE

1949

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Chairman.

Dr. G. S. **CHEEMA**, I.A.S. (Retired), former Fruit Development Adviser to the Government of India.

Members.

Dr. T. S. **VENKATARAMAN**, I.A.S. (Retired), former Sugarcane Expert to the Government of India, Thyagaroyanagar, Madras.

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Secretary.

Sri C. R. **SRINIVASA AYYANGAR**, L.AG., Headquarters Deputy Director of Agriculture (Research), Madras.

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SUMMARY OF THE MAIN FINDINGS AND RECOMMENDATIONS OF THE EXPERT COMMITTEE.

When reviewing the research work of the Madras Agricultural Department during the five-year period, 1944 to 1948, the Committee had necessarily to take a rapid survey of research work and achievements previous to the survey period. The Committee find that, on the whole, the tempo and standard have been maintained This has enabled it to make suitable recommendations for rectifying noticed defects and channelizing work in the future.

In the field of crop-breeding, which, in the past, has been one of the most effective lines of crop improvement, advances have been recorded in all the crops. In the major crops like paddy and cotton the possibilities of pure-line selection would appear to have been exhausted and future advances would appear to lie in new introduction and hybridization.

The millets, which are the staple food of the poor all over the Province, received attention from the department much later than the main crops and, is in some respects, their breeding is even more difficult than of others. The Committee recommend the intensification of breeding work particularly with regard to regional requirements and suitability.

Work on oil-seeds—also recent—has registered considerable advance during the review period and the 80-year old coconut has been added. Besides their important role as food for men and livestock, some of them like the groundnut and the coconut, have exportable values for earning for the Province both hard and soft currencies in the world markets

During the period the plant protection services of the Department have got closer to the grower through the organization of special staff to deal with mass incidence of pests and diseases in the districts. This phase of the work has gained materially from wonder drugs like the D.D.T. and Gammaxane—both war-babies—and rendered the departmental recommendations effective for the first time in protecting large crop areas. As protection from crop enemies is as important as the growing of crops, the Committee recommend the strengthening and affording greater facilities as need arises.

The manurial experiments and trials which are as old as the Department itself, have resulted in specific recommendations with regard to particular crops. The fact that green manuring is, after all, the cheapest and best, besides being not dependent on imports from other countries, the Committee have made bold to suggest a scheme of compulsory sowing by the Department, if need be, of seeds of green manure crops at the time of paddy harvest in the deltaic tracts.

One important basis on which crop improvement work has been built up in the past is the introduction of improved types from the research stations. But pure seed thus distributed soon deteriorates at the hands of the ordinary cultivator, thus nullifying the work expended in evolving the types. The Committee feel strongly about the need for supplying to the cultivator reliable seed in sufficient quantities and well in advance of the time he needs them. The Committee consider that this should be the responsibility of Government under the conditions of the Province and has made recommendations to ensure seed supply even at some cost to Government any such expenditure being considered as legitimate part of research expenditure from which the Government do not expect immediate material returns.

The inadequacy of measures, for translating results of research in the cultivators' fields, has been commented on both in the press and platform and had attracted the attention of foreign visitors to the country. Owing to its importance the Committee have been paying marked attention to this aspect in its tours and discussions with the district staff. Certain defects have been noticed and it has been found that, the taking up of trading schemes by the Department, has lowered both the quantity and quality of demonstration and propaganda work. It has been found that the prevalent complaint in recent years about the poor germinating quality of seeds distributed by the Department is justified and has traced the causes recommending its full development in the future by carefully controlling rye growing and ergot production in the Nilgiris to make India as a whole self-contained in the matter of this valuable drug. High quality ergot, greatly superior to the usual world product in alkaloid contents, has been produced by careful scientific work and as the world gets to know of this production, the profits may increase in future years. The Committee are making recommendations to take advantage of the present favourable conditions for the full development of this venture.

Yet another Agro-industry—now in its initial stages—is the work on preservation and canning of fruits and vegetables in the fruit station at Kodur. Suitable development of this line of work in the future might give the Province a paying industry, improve the dietetic value of the South Indian and lead to the extension of fruits and vegetables in the Province. The Committee recommend that the fruits of the common man should receive attention in the future so that cheap fruits and in quantities would be available to the common man also.

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leading to this bad quality. The Committee are making suitable recommendations for effectively rectifying the noticed defects and re-winning the confidence of the cultivators in the matter of seed supplied. The recommendations involve some expenditure but this is essential for the good name of the Department and proper service to the agriculturists.

In the line of Agro-Industries, the Committee find that this Province is in certain respects ahead of other Provinces and it is to the credit of the Madras Government and its Agricultural Department that certain of these investigations have been carried on to the pilot plant stage.

The Malt Factory at the Agricultural Research Institute, Coimbatore, is working on a grain which is greatly inferior to the world renowned barley used for malting. This has resulted from the highly commendable idea of utilizing for manufacture of malt locally available grain. This factory is not likely to pay unless barley is grown nearby on the Nilgiris or some other grain of equal value to barley is found. The Committee are rather surprised that the other Provinces growing barley like that of United Provinces have not taken up this work. Having taken the investigational work to the pilot plant stage, the Committee consider that it is now best left to the Industries Department or private agencies to take up.

The Yeast Production Unit at the College has shown the possibility of this valuable vitamin food being produced easily in the Province. As the plant now uses molasses as base material, it would appear that the location of the yeast plants in close proximity to a sugar factory where this stuff is available almost as waste product is indicated. The Mycologist should, however, continue the work for finding alternative base material that is available locally and at cheaper rates. Here again the investigation is ripe for private enterprise to take up and develop.

The Scheme of Ergot Production in the Nilgiris on rye which was introduced for this purpose, is a lucky find. technique, the originators have discovered an agro-industry, which is paying even in the initial stages. The Committee is With very simple equipment, a small staff and an easy

REPORT OF THE EXPERT COMMITTEE.

INTRODUCTORY.

In pursuance of the recommendations of the Retrenchment and Re-organization Committee, the Government of Madras appointed (vide G.O. No. 919, Food and Agriculture, dated 9th September 1949—Appendix I), an Expert Committee consisting of the following members :—

Chairman.

Dr. G. S. Cheema, I.A.S. (Retd.), former Fruit Development Adviser to the Government of India.

Members.

Dr. T. S. Venkataraman, I.A.S. (Retd.), former Sugarcane Expert to the Government of India, Thyagaroyanagar, Madras.

Dr. D. V. Bal, M.SC., Director, Institute of Plant Industry, Indore.

Dr. Jayachand Luthra, I.A.S. (Retd.), Principal, Agricultural College, Benares Hindu University, Benares.

Secretary.

Sri C. R. Srinivasa Ayyangar, L.AG., Headquarters Deputy Director of Agriculture (Research), Madras.

" To review the progress of agricultural research in the province during the five-year period 1944–48, in order (*a*) to assess the value of the results achieved so far in terms of practical application to agriculture and (*b*) to suggest further lines of work to be carried out in all branches, viz., soil science, manures, crop improvement, plant protection and development of agricultural industries "

2. Under directions from the Government, the Director of Agriculture furnished the members of the Committee, copies of detailed reports of the various Research Sections, on the progress of work during the period under reference and the programme of work for the next three years. The Government of Madras advised the Committee to submit the report within six weeks from the date the Committee commenced their work. In accordance with the tentative programme proposed by the Director of Agriculture, Madras, the Committee assembled at Coimbatore on the 19th September 1949. Dr. G. S. Cheema and Dr. T. S. Venkataraman joined the Committee on the 19th September, while Dr. Jayachand Luthra joined on the 28th September. The Secretary of the Committee joined on the 20th. Nothing was heard from Dr. D. V. Bal after his last telegram of 20th September communicating that he would be joining the Committee after the 24th September. The Committee was expecting Dr. Bal to join till about the 9th October but he did not join. The remaining

three members of the Committee, however, continued the set programme to complete the work within the time limit prescribed. Later, it was found that the inspection and writing of the report could not be finished within six weeks. A week's extension from the 2nd November was thought necessary and the Government in their Order No. 1211, Food and Agriculture, dated 22nd October 1949, extended the period up to 14th November.

3. On the 20th September, the Committee held a preliminary meeting with the Heads of Sections at Coimbatore and this was helpful in drawing up the Committee's programme. A draft questionnaire prepared by Dr. Venkataraman was placed before the meeting and after some discussion, it was decided that Heads of Sections should furnish the Committee with answers to the questionnaire along with a summary of their detailed report. Each member of the Committee individually inspected the various sections at Coimbatore and held detailed discussions with them.

TOURS.

4. The Committee inspected the various research sections, and the breeding stations, workshops and laboratories at Coimbatore, from 19th to 30th September, and again on 8th and 9th October. The inspection of the important representative regional Agricultural Research Stations was taken up from 30th September to 27th October in four tours, viz. :—

(*a*) Tour in the West Coast districts and Nilgiris to inspect the stations at Pattambi (Paddy), Nileshwar (Coconuts), Mangalore (Paddy), Wynaad (Colonization units and fruits), Nanjanad (Potatoes) and Ootacamund (Botanical gardens) and Sim's Park (Ornamental gardening) and the Pomological stations at Coonoor, Burliar and Kallar from 30th September to 7th October.

(*b*) Southern districts covering the Agricultural Research Stations at Koilpatti (Cotton and Millets), Aduthurai (Paddy and Plantain), Tindivanam (Oilseeds) and Tirurkuppam (Dry and semi-dry paddies) between the 10th and 15th October.

(*c*) Northern districts covering the Sugarcane Research Stations at Anakapalle (Sugarcane and Paddy) and Samalkot (Paddy and Plantain) from 16th to 20th October.

(*d*) Tour in the Ceded districts covering Kodur (Fruits), Hagari (Cotton and Millets) and Siruguppa (Irrigation and Agronomic Research Station) from 22nd to 27th October.

Officers in charge of stations which were not scheduled to be visited were invariably called to the nearest place of visit and their work discussed. The Committee also made it a point to contact cultivators (big and small) wherever possible. Special mention may be made of the discussions the Committee had with a large number of ryots who had come to the depots at Koilpatti and Tindivanam, Kodur and Kumbakonam for purchase of seeds and iron materials and the large assembly of ryots supplying cane to the Etikoppakha Sugar Factory. Wherever possible, the Committee visited the departmental depots as also organizations connected with the marketing of agricultural produce like the

Groundnut Marketing Yard at Tindivanam and the Orange Grading Centre at Koduru.

5. In response to the directive from the Government (vide G.O. No. 1138, Food and Agriculture, dated the 12th October 1949), the non-officials mentioned in the letter were also requested to meet the members either at Madras or at Coimbatore. Sri V. T. Arasu kindly met the Committee on the 21st October at Madras and Sri M. Bapineedu at Coimbatore on 30th October and discussed several important points with it. Sri Naganna Gowda of Hospet accidentally met the Committee at Bellary and gave his valuable experience and suggestions about the work of the department in his tract. Sri G. Rajagopal Pillai, Panniyar, Bikshandarkoil, kindly communicated has valuable suggestions to the Committee.

RESEARCH—GENERAL OBSERVATIONS.

6. Research is largely uncertain of results, which cannot be brought out according to calendar. The extent and quality of research are governed firstly by sound planning, secondly by evolving a suitable technique, and thirdly by the continuity of methods and programmes in the hands of competent and devoted workers. The present review should, therefore, evaluate the importance of these three pre-requisites rather than the actual quantitative achievements. With this spirit, the Committee has examined the research work of the Madras Agricultural department for the period 1944 to 1948.

Except the Fruit and Sugarcane Specialists, all the other specialists have their main stations and laboratories at Coimbatore. Besides the Central Stations and laboratories at Coimbatore, research facilities are available at the Agricultural Stations in the district and regional centres for tackling local problems. The Committee now proceeds with the review of the work and its recommendations under different headings below.

RESEARCH COUNCIL.

7. A Research Council consisting of Heads of Research Sections at the Agricultural College, including the Senior Lecturer in Agriculture, representing the District Organization has been functioning since 1933. The Council was originally formed to scrutinize three-year programmes of work and review the progress of work every half-year. Based on these, the Director of Agriculture then submits every half-year a review of progress and a final consolidated report at the end of each three-year period. For some time past, the Council has also been scrutinizing the cropping schemes of Agricultural Research Stations, their annual reports and the annual reports of Heads of Sections to secure uniformity of presentation. No experiments are discontinued or new ones introduced without the express approval of the Council. The Principal is the ex-officio Chairman of the Council and the Vice-Principal, the ex-officio Secretary. Elsewhere in this report, the Committee are making recommendations to increase the efficiency of this Council. The Committee feel that this arrangement is very useful for co-ordinating the research in the various

sections. The work of the Council has considerably increased in recent years and the need has now arisen for a suitable staff addition to the Council for dealing with its work efficiently.

CROP IMPROVEMENT WORK—GENERAL REMARKS.

8. Among the various research activities of the Agricultural department, the improvement of the chief crops of this province, viz., paddy, millets, cotton, oilseeds and pulses has not only made the largest contribution to the crop production but also will continue to be the main items in both research and propaganda work of the department. The district staff have to devote a good portion of their time not only to cover every bit of cultivable land with improved strains, but also maintain the improved varieties pure. The common methods of all crop improvement consist of—

(i) Isolation of high-yielding strains, largely by selection, possessing ancillary charecters to fit them into the conditions of the tract such as earliness or lateness, non-lodging habit, resistance to pests and diseases and quality of produce, such as oil content in oilseeds, lint length in cotton, protein in pulses and milling percentage in rice.

(ii) Evolution of desirable strains by bringing together in the resultant plant, through hybridization, economic characters from cultivated or wild species.

(iii) Inducing mutations by special treatments, like X-ray, or isolating natural mutants in the field.

(iv) Improvement or cheapening of agricultural practices.

Here below are given the review of work during the period and recommended future lines of work crop-wise.

PADDY.

9. The normal area under paddy is 10·775 million acres (8·520 irrigated, 2·234 unirrigated) and is 30 per cent of all the crops sown in a year. The normal production is 7·263 million tons of paddy. The normal average acre yield of the Presidency works out to 1,794 lb. for the irrigated and 1,303 lb. unirrigated. Paddy being the major food crop of the province, the department took up its improvement as early as 1913, by appointing a Paddy Specialist with a Central Paddy Breeding Station at Coimbatore. The number of varieties of rice at present in the Coimbatore collections is over 1,500 (Indian origin). This is in itself an expression of the fact that the crop is highly specialized in its adaptation to local conditions. Hence attention was at the outset devoted to regionalize the work by opening sub-stations in the major rice-growing areas. In addition to the Central Paddy Breeding Station at Coimbatore, rice improvement work is now carried out at Aduthurai for the Cauvery irrigated areas, Maruteru for the Godavari, Krishna and Guntur districts, Samalkota for East Godavari, Anakapalle for South Visakhapatnam, Pattambi for Malabar, Ambasamudram for the Tambaraparani basin, Buchireddipalayam for the North Pennar irrigated area in the Nellore and Cuddapah districts, Mangalore for the South Kanara district and Palur and Tirurkuppam for the dry and semi-dry paddies of

the Chingleput, North Arcot, Chittoor and South Arcot districts. At the start, a regional station, devotes its chief attention to the evolution of high-yielding strains from the local crop material by the pure line selection method. This has resulted in strains of outstanding merit. Side by side evolution of strains by hybridization of the local strains with suitable parents as well as agronomic research is being pursued.

10. During the five-year period under review, pure line selection work has resulted in the release of CO. 22 and CO. 23 from the Paddy Breeding Station, Coimbatore. At Maruteru, the two dry land varieties of paddy MTU. 17 Kodi Budama and MTU. 18 Kodi Jillama were distributed for general cultivation in the black soils of Godavari. During this period, four strains for the first crop (PTB. 18 to PTB. 21) and four strains for the second crop (PTB. 22 to PTB. 25) were multiplied for distribution from the Pattambi station. In the Tambaraparani basin, the strains isolated from the chief local varieties (ASD. 1 to ASD. 7) were multiplied on a large scale. To the credit of the Research Station Buchireddipalayam stand the two strains BCP. 1 and BCP. 2 which were selected for high resistance to blast disease for distribution in the Nellore and Cuddapah districts. Selection work is in progress at all the regional stations for effecting further improvements. Promising cultures are in different stages of filterations in the Research Stations at Tirurkuppam and Mangalore. In the field of hybridization, special mention has to be made of the two outstanding hybrid cultures CO. 25 and CO. 26 for their high resistance to blast disease. In years, when the disease appears these strains yield from 25 to 50 per cent more than the local. These two strains are expected to cover over five lakhs of acres in due course in the Southern and Central districts. In the year 1948–49, it is estimated that they have already covered 20,000 acres. The effect of the release of these two strains will be appreciably felt in the next two years if the progress and programme of distribution are maintained. MTU. 10, a hybrid culture between Kusuma, a coarse variety occupying more than 70 per cent of the area in the Krishna and Guntur deltas and GEB. 24, has all the good characters of Kusuma and the grain character of GEB. 24. The strain is now rapidly replacing the Kusuma MTU. 7, an earlier release. From the same cross, a few hybrid cultures were sent from Maruteru to Samalkota for study and selection of suitable cultures for that tract. It was noticed that SLO. 17, Gutti Kichilli (bunched) and SLO. 18, Sanna Kichilli, yielded better than GEB. 24. They are now spreading in areas where GEB. 24 was formerly popular in the uplands of Godavari and South Visakhapatnam. At Pattambi one hybrid culture 2,801 isolated from PTB. 9 cross is free from the defective character noted in PTB. 9 and is in the final stages of trial.

11. The following special crosses made for different purposes are in various stages of study :—

(i) Evolution of *Piricularia* (Blast) resistant strains of different durations. This problem is assuming great importance especially as the cultivators are now getting more manure-minded. High manuring pre-disposes the paddy crop to blast disease.

(ii) Evolution of alkaline-resistant strains to stand different degrees of alkalinity.

(iii) Evolution of strains resistant to deep water conditions.

(iv) Production of cosmopolitan types useful over large areas. This is an attempt to reduce the number of strains as far as possible for easier handling in the districts.

(v) Evolution of ecological types suitable for precarious conditions of moisture resulting from unevenly distributed rainfall.

(vi) Regular crosses are being attempted every year between the wild species and cultivated forms. Many of the first generation crosses are sterile and the Cytogeneticist is working on a method to restore fertility. He is also trying the various methods of inducing mutations by X-ray and chemicals.

12. It is stated that annually 300—350 tons of pure nucleus seeds to cover 15,000—20,000 acres of primary seed farms are made available from the various rice research stations to the district staff. The seed purchased from the primary seed farms are to be utilized for large scale multiplication in what are known as secondary seed farms. In most of the major paddy areas like Tanjore, Tiruchirappalli, Godavari, Krishna, Guntur and some of the Central and Southern districts like Coimbatore, Salem, North Arcot, Mathurai and Tirunelveli the strains have spread over large areas. It has become very difficult to keep track of their spread and in many areas, the old local varieties are not traceable. But the seed in the hands of the farmers soon gets contaminated and needs replacing once in three or four years. In the present set-up of the district staff, it is found that the Agricultural Demonstrator for a taluk is not able to devote the requisite amount of attention and care to seed multiplication and distribution owing to multifarious heavy duties in connexion with the 85-A Trading Schemes. It is reported that the quality of seed distributed is poor for want of adequate care in the fields and percentage of germination is low due to bad storage and want of drying facilities. Further, it was also mentioned that the purchase price of seed is fixed high to induce the seed farm ryots to part with their produce. But this high premium (25 per cent over the village notified price) together with the incidental charges puts up the selling price of seed so high that farmers are unwilling to pay the price demanded at the Government depots. This very often results in a large stock of seed unsold at the end of the season. The Committee are of opinion that while there is a need to attract seed farmers with remunerative premium to cover extra charges for the care bestowed in rogueing, harvesting, threshing and cleaning and cover loss in dryage, it is not advisable to put up the selling price by the department merely to make the seed distribution schemes self-supporting. The premium paid to the seed farmers should be subsidized by Government and seed

sold to ryots at prevailing market rates. The premium paid should be considered as part of expenditure on Paddy Research, from which no immediate gains are expected. It is only when the seed paddy is made attractive to the buyer by its purity and high viability and at market prices, that cultivators would be inclined to purchase improved seeds from the departmental depots in a larger extent than at present. In some tracts, where the cultivators are extremely poor and are under tenants as in Malabar, South Kanara, Visakhapatnam and Central districts, there must be a provision to exchange seed paddy with paddy kept for his food.

As regards the supervision of seed farms, care in proper drying and storage of seeds in the depots, it is hoped that the Seed Development Officers and their staff, recently sanctioned, would rectify the existing defects. The working of this scheme should be carefully watched and necessary facilities augmented as and when needed.

13. The Committee lays special emphasis on the production and distribution of best quality seed. All facilities should be available to build up a good seed organization to which any ryot can go with confidence to get his seed requirements well in advance of the sowing time. Otherwise all the money spent on the production of strains would be wasted. Distribution of proper seed to the growers as they need them would definitely and materially contribute to wipe off the present deficit in this staple food of the Province.

14. The results of manurial experiments at the several stations have shown that all kinds of oil-cakes are equally efficacious when they are applied on equal nitrogen basis. The choice, therefore, for one or the other depends upon its availability and cost in term of unit nitrogen. Combination of organic and inorganic manures has been found to be more effective than when each is applied alone. Application of 4,000 lb. of wood ash to the laterite soils of Malabar has increased the yield of transplanted paddy at Pattambi. The results of irrigation experiments once more, confirm that a standing film of water (2″) is conducive to higher yields. The following experiments are in progress :—

(i) To study the response of high doses of nitrogen up to 120 lb. in combination of $P_2 O_9$ plus K_2O.

(ii) To study responses of varieties to climate, soil, irrigation and drainage.

Results of spacing experiments have shown that 4 to 6 inches spacing is the optimum in most of the paddy areas, while 8 inches spacing gave the best result in Maruteru. Under manured conditions, a seed rate of 60 lb. per acre is found to be sufficient, while under unmanured conditions, the seed rate has to be increased to 100. The problems relating to the deterioration of the viability of Co. 3 produced in the second crop and stored in the South Kanara district during the monsoon is being studied.

It was found that storing of seed in metallic bins maintains the viability of seed better than the local method of storing seed paddy in straw bundles (*mudas*). But metallic bins are costly. Further research has shown that soaking the seed for 30 minutes and drying them in shade for three or four hours prevents this deterioration. This is to be confirmed.

15. It has been brought to the Committee's notice that in spite of covering over 50–60 per cent of the area under improved strains, distribution of manures, adoption of improved cultural practices and bringing larger area under cultivation, the total output of the Province as given in the Season and Crop Reports has not showed any appreciable increase.

In the first place, in a Province where rice is cultivated under a variety of conditions of soils, climate and rainfall, the overall output cannot show progressive increase because in any particular year one area or other, often suffers from adverse conditions. While this report is being written, news has come of extensive damage to the rice crop in the deltaic tracts of Godavari and Krishna. The yield of paddy varies widely from year to year in the same locality depending on the distribution and quantity of rainfall and the good effect of the various efforts to increase production are very often nullified by a number of adverse factors. One such factor is the lowering of fertility through constant cultivation and it is not being fully replenished by adequate manuring A second possible factor is that owing to high prevailing prices, inferior marginal lands, not quite suitable to the crop, have been brought under cultivation. But for the persistent efforts to improve the yield of paddy through high yielding strains and manuring, etc., the total output of the Province might have fallen more than what has been recorded. It may be mentioned that yield is not an unit character and that a new strain, however inherently high yielding, fails to give best results unless all the favourable factors are also available.

16. Though the improvement work of rice in the Madras Province has reached a stage where, for the most important paddy tracts, improved strains are available, there are yet areas where specific problems are yet unsolved and there are strains which need improvement in their ancillary characters. The expansion of the Ambasamudram station to serve Ramnad and Mathurai and the selection of a bigger site in Nellore for working on the second crop, intermediate season varieties and rotational crops for the tract, should be taken up at an early date.

The North Visakhapatnam being a special area more akin to the Orissa Province requires a separate station, to work on varieties suitable for semi-dry conditions and evolve Kodu (silver shoot) and blast resistant types maturing before December. Small temporary sub-stations attached to the nearest major station to deal with special problems like deep water in Collair area, upland tank-fed areas of Krishna and Godavari districts and the saline area of Central and Ramnad district should also be started on leased land.

At the Central Paddy Breeding Station the lines of work—both fundamental and applied—should be intensified.

17. The Committee strongly feels that rice being the staple food in the Province and being in deficit production, every effort should be made to cover all the existing area under rice with improved strains. Rice has become a world product of commerce. The exporting countries cannot be depended upon to reduce prices to suit the purse of the poor Indian consumer. It is of national importance, therefore, to make the Province self-sufficient in rice.

MILLETS.

18. Millets are the poor man's food and are next in importance to only paddy, occupying 27 per cent of the area cropped in the Province. There are eight millets grown in the Province of which cholam, cumbu, ragi and tenai are the most important. The Central Millets Station in charge of a Millet Specialist was opened in 1923 at Coimbatore. This station in the earlier years, confined its attention primarily to collection of varieties, the study of botanical characters and the genetics of the various millets. As knowledge accumulated on the different millets and trained men became available, the improvement of millets in the different regional research stations, viz., Hagari, Nandyal, Koilpatti, Guntur, Anakapalle and Palur was taken up. The normal area and production of the different millets are given below :

	Irrigated.	*Unirrigated.*	*Total.*	*Production.*
	In million acres.	*In million acres.*	*In million acres.*	*In million acres.*
Cholam	0·456	4·372	4·828	1·149
Cumbu	0·324	2·273	2·597	0·616
Ragi ..	0·922	0·826	1·748	0·760
Tenai ..	0·067	1·542	1·609	0·207
Varagu	0·031	0·987	1·018	0·314
Samai ..	0·008	0·565	0·573	0·097
Total ..	1·808	10·565	12·373	3·143

The number of varieties in each millet is not only large but the usefulness of strains is often limited to a narrow set of conditions.

19. Among the unirrigated varieties of cholam, *Peria Manjal* (Yellow) is important and a strain Co. 1 is replacing the local both as a grain and a fodder crop. It is also found suitable as a fodder crop alone in some of the Southern and Central districts. In order to improve its grain size and quality of straw, crosses have been effected with types possessing bold grain and with types having juicy stem. Crosses to evolve a type of *Peria Manjal* cholam resistant to *Striga* (root parasite) have been made under a comprehensive scheme of *striga* research in four centres—Hagari, Nandyal, Guntur and Coimbatore. Two strains of Thalaivirichan cholam isolated at Coimbatore and one at Anakapalle have been released. This variety is poor both in straw quality and grain size. Further crosses to rectify these defects are under study. The Irungu type (enclosed glame) is grown on the poorer dry lands of the Southern districts for fodder. Crosses with the object of inducing bolder grains in Irungu types are under study at Koilpatti. Different types of *Pacha Jonna* are grown in the different zones of Circars and Ceded Districts. Two improved *Pacha Jonna* strains have been released from Anakapalle and three from Guntur and five from Nandyal. Recently four additional strains were put out from Nandyal to suit some of the sub-regions of the districts of Cuddapah and Kurnool. In the *Tella Jonna* area of Bellary, a strain T-1 isolated at the Agricultural Research Station, Hagari, is spreading in the Bellary and Anantapur districts. Among the introduced types M. 47-3 of Bombay, by virtue of its earliness, has found favour in the shallow soils of Bellary. Experiments conducted at Siruguppa have conclusively proved that T-1 *and M.* 47-3 are the most suitable strains for growing in the Tungabhadra Project area during the *hingari* season. Crosses made to reduce the duration period of *T*-1 *Jonna* are under study at *Hagari* and Siruguppa. Among the *Sencholam* (Red) group, one strain from Guntur has been released and another from Tiruchirappalli is under trial.

20. *Irrigated cholam.*—Though the area under irrigated cholam is mostly confined to the Southern and Central districts and this area is comparatively smaller than that of the unirrigated, yet high yields obtained through irrigation and manuring—nearly three times that of rain-fed cholam—render the irrigated cholams important for the Province. These vary in duration from 90 to 120 days. Four strains of *Vellai cholam* for the Coimbatore area and one from Koilpatti for the Tirunelveli area are under distribution. The most recent among them are Co. 12 and Co. 13. A few taluks of Coimbatore district grow the *Chinna Manjal Cholam*, in which a high yielding strain Co. 5 has been released. Further work to improve its grain size and fodder value is on hand. Another important group of irrigated cholam is the *Sen Cholam* (Red) of the Central and Southern districts. Co. 4 a high yielding strain has already been selected, but its usefulness is limited on account of its small grain. Crosses with African bold grain Sorghum have been made to improve grain size.

21. A list of strains of Sorghum released from the Millet Section so far is given below :—

Name of station.	*Strains released.* *Before* 1944.	 *After* 1944.
Millet Breeding Station, Coimbatore ..	CO. 1, 2, 3 and 5.	CO. 6, 7, 8, 9, 10, 11, 12 and 13.
Agricultural Research Station, Anakapalle.	AKP. 1, 2, 3, 4 and 5.	..
Agricultural Research Station, Guntur ..	G. 1 and 2.	G. 3 and 4.
Agricultural Research Station, Nandyal.	N. 1, 2, 3, 4 and 5.	N. 6, 7, 8, and 9.
Agricultural Research Station, Hagari, Bellary.	H. 1 and M. 47-3.	..

22. *Cumbu.*—This is known as the Pearl Millet and the next important millet in the Province. The varieties of this millet fall into two groups : (*a*) rain-fed and (*b*) irrigated, the latter occupying only about 10 per cent of the total area under this crop. Their duration ranges from 90 to 120 days. Work on this crop is in progress at the Central Research Station at Coimbatore, and also at Anakapalle, Guntur and Koilpatti. Three strains of Cumbu were isolated and released for distribution from the Millet Breeding Station, Coimbatore, two from Anakapalle and two from Koilpatti. These strains give on the average 15 to 20 per cent more yield than the local types. The Anakapalle strains have spread in the districts of North and South Visakhapatnam, the Koilpatti strains in parts of Tirunelveli and parts of Mathurai, Ramnad, South and North Arcot and Chittoor districts. Co. 1 is the most popular of them all. However, none of the above strains was found to be suited to the bulk of the area in the Ceded districts, Nellore, Guntur, etc. Hence selection work is being continued to isolate high-yielding strains suited to these tracts. One introduced type from Bombay gave consistently high yield at Anakapalle and was given out as AKP. 3. Cumbu seeds were exposed to X-ray material, but with no useful results.

23. In its floral mechanism Cumbu is protogynous with a high percentage of natural crossing. Hence it was considered desirable to take advantage of this special feature and test the possibilities of harnessing hybrid vigour for increasing yields. Hence this new line of work has been taken up in this millet for the evolution of high yielding strains. A scheme for the production of hybrid strains in Cumbu was sanctioned by the Madras Government and this is in progress from 1946. During the period under review more than 700 crosses were made and tested for hybrid vigour and yield. As a result of this special work, two hybrids X-1 and X-2 have been obtained, which are outstanding in their yield performance both at the research station and in the districts. These

hybrids are now under trial in over 60 taluks in this Presidency. From the reports received so far, the hybrids have recorded yields ranging from 22 to 164 per cent over the yield of the local types. Seed farms for large-scale production of these hybrids were arranged in these taluks. More than 40,000 lb. of hybrid seeds have now been procured for large-scale distribution.

24. A list of strains released in Cumbu from the different Agricultural Research Stations is given below :—

Name of station.	*Strains released.*	
	Before 1944.	*After* 1944.
Millet Breeding Station, Coimbatore ..	CO. 1 and 2.	CO. 3 X-1 and 2.
Agricultural Research Station, Anakapalle.	AKP 1 to 3.	..
Agricultural Research Station, Koilpatti.	K. 1 and 2.	..

25. *Ragi.*—Ragi is one of the smallest grained cereals and one of the most important millets in this Province. Unlike cholam and cumbu, the difference between irrigated and unirrigated varieties are of minor importance and most of them thrive well under both the systems of cultivation. About 102 different varieties are known with their durations ranging from 90 to 150 days, the longer duration types being grown under rainfed and the shorter duration types being grown under irrigated conditions. The improvement of this millet was taken up at the Millet Breeding Station, Coimbatore, and also at other centres. All the major varieties of the different districts were collected and studied at the Millet Breeding Station and four high yielding strains, ranging from 110 to 140 days in duration, were released for trial in this Province. Perhaps it is rare to find one strain suitable for as many as 17 districts, but Ragi Co. 1 has achieved this remarkable distinction. Apart from the Coimbatore strains, seven strains were released from Anakapalle and one each from Hagari, Palur and Koilpatti. Selection and hybridisation were continued at Coimbatore to isolate short duration types giving high yields of grain and straw. The promising cultures belonging to these groups are in various stages of yield trials. Similar selection work is in progress at Anakapalle, Palur and Koilpatti. AKP. 1 of Anakapalle gave higher yields and was also earlier than the Palur strain R. 382 at Palur. Eight early selections are under study at this station. Similarly 140 cultures made from local collections are under tests at Koilpatti. Efforts made at Coimbatore and Koilpatti to isolate types resistant to *Piricularia* disease of ragi, were not successful. Cultural experiments done at Anakapalle showed that 14 to 28 days old ragi seedlings planted in holes ¾ link apart gave the highest yield. In a manurial experiment at Anakapalle it was found that 40 lb. of nitrogen applied in the form of groundnut cake gave the highest yield of grain and the largest margin of profit.

26. A list of strains of ragi released from the different Agricultural Research stations so far is given below :—

Name of the station.	*Numbers of strains released.*	
	Up to 1944.	*After* 1944.
Millet Breeding Station, Coimbatore ..	Co. 1 to 3.	Co. 4
Agricultural Research Station, Anakapalle.	AKP. 1 to 3.	AKP. 6 and 7.
Agricultural Research Station, Koilpatti.	K-1.	..
Do. Hagari ..	..	H-1.

27. *Tenai.*—This is the fourth millet in acreage and importance in the Province. Of the total area of 15 lakhs of acres under this millet more than 87 per cent is in the Ceded Districts, where it is often grown mixed with cotton. The improvement of this crop through selection has been in progress at the Millet Breeding Station, Coimbatore, and also at Guntur, Nandyal and Hagari. Three high yielding strains were released for distribution from Coimbatore, two from Hagari and one from Nandyal and Guntur. The strains released from Coimbatore were found suitable for the districts of Coimbatore, Salem, South Arcot, Chingleput, Tiruchirappalli and Mathurai. The three strains released from Hagari and Nandyal have spread over two lakhs of acres in the Tenai area in the Ceded Districts. Selection work was continued at all the four stations to isolate high yielding strains. To evolve types resistant to rust disease, work has been in progress from 1944 and three selections have been isolated. This work is being continued at Hagari also and resistant types are under test at both these stations. The study of rust resistance and the evolution of resistant types require continuous attention.

28. A list of strains released from the different stations so far is given below :—

Name of the station.	*Numbers of strains released.*	
	Before 1944.	*After* 1944.
Millet Breeding Station, Coimbatore ..	Co. 1 to 3	..
Agricultural Research Station, Guntur ..	G-1	..
Do. Nandyal.	N. 1 and 2	N-3
Do. Hagari ..	H. 1 and 2	..

29. *Minor millets.*—The four small grained millets coming under the group of minor millets are varagu, samai, panivaragu and Kudiraivali. They are cultivated in areas of low fertility and these grains are generally consumed by the working classes. High yielding strains PS-1, PM-2 and PV-14 have been evolved in this group and are being distributed in the districts.

GENERAL REMARKS.

30. At the Central breeding station, the study of the fundamental aspects of the problems connected with millet improvement like the inheritance of economic characters, the response of seed treatment to various growth substances and study of hybrid progenies

should be continued. In addition to these, the evolution of improved strains of millets for the Coimbatore district and the neighbouring districts of Salem and Tiruchirappalli should also be pursued. The production of hybrid strains in cumbu and the production of cosmopolitan strains in millets, if any, should be intensified. The present cosmopolitan strains are Co. 1 in cumbu and Co. 1 in ragi.

In the sub-stations, the current progress as per programme should be continued for the benefit of the local area.

31. Initiation of work in new areas, as described below, should also be undertaken. Millets are very local in their character and disposition. Recently in the Kurnool district in the course of breeding work on cholam, it was found that no single strain of cholam could cover even one entire district. After intensive study, it was found that there are as many as nine different ecological types of yellow cholam suited to distinct sub-areas in the district. Another difficulty is that the varieties brought from the different sub-areas would not do well at Nandyal which rules out the carrying out of breeding work at Nandyal for these areas. The Committee understand that a small and cheap scheme has been submitted by the Millet Specialist recently to Government to take up sub-station work in three centres of this *yellow cholam* tract for doing the work. The Committee are much pleased with this comparatively cheap method of carrying on extension work on regional crop breeding and selection and considers that this method is distinctly worth a trial.

32. Out of 12 million acres under all millets put together it is estimated that an area of 0·7 million acres are under improved strains. The Committee particularly notice that the area covered by the improved strains of millets in the Province is very small compared to the total area and they recommend that every effort should be made to increase the area under the strains by special attention to the seed multiplication and distribution either on subsidised or exchange basis as detailed under paddy. Millets being a poor man's food and poor man's crop, much greater attention than for other crops should be paid by Government. There is no scope for increasing the yield of millets by manuring and irrigation as they are mostly rainfed and grown on poor lands by poor farmers.

PULSES.

33. The important role of Pulses in the South Indian diet cannot be overestimated. They form the chief source of protein food. The normal area under all pulses is three million acres, and half of this is under horsegram alone which is used as feed for cattle and horses. This Province is in deficit in pulses to the extent of 3·22 lakhs of tons, which is imported from Hyderabad and North India.

The Cotton and Millet Specialists, in addition to their main work, were devoting some attention to the improvement of pulses coming in rotation with their crops. As a result of their work, strain—2900 in redgram and three strains—468, 482 and 2965 in Bengalgram were isolated and are now in cultivation. In the year 1943, a scheme for the pulses improvement work was sanctioned by the Indian Council of Agricultural Research. A Pulses Specialist with five Research Assistants was appointed at Coimbatore. Two small regional sub-stations at Salem and Vizianagaram were also opened to work on the varieties of Central and Northern districts. The object of the scheme is the isolation of high yielding strains resistant to diseases and satisfy the trade requirements for bold size of grain, attractive colour and good cooking qualities. The scheme has been running for the past five years. The following promising cultures in each of the pulses, yielding as much as 20 per cent increase over the unselected bulk, await district trials.

Station.	*Culture number in*						
	Red-gram.	*Cowpea.*	*Black-gram.*	*Green-gram.*	*Horse-gram.*	*Field lab-lab.*	*Bengal-gram.*
Coimbatore ..	74	17–86	281 and 284.	62	16–18	14–58	94
Salem	37	..	..	..	122	44	..
Vizianagaram ..	97	..	189	127	93 (black) 76 (buff).	..	..

34. The pulses are largely rotational crops with either cotton or millets and the cotton and millet stations to have perforce to grow the pulses in rotation with their main crop. Before the appointment of the Pulses Specialist, both the Cotton and Millets Specialist had done work on pulses in addition to their work on the main crop. The strains (redgram and Bengalgram) now under distribution are results of this Pre-Pulses Specialist's work. The whole section is at present temporary and the work is being carried on in the Central Farm lands in Coimbatore and on leased lands in Salem and Vizianagaram. The disadvantages of growing selected cultures on land given by the Central Farm from year to year is obvious. For proper tests, it is necessary that the breeder should have both knowledge and control of the cropping practices preceding that of the test plots. The area given to the Pulses Specialist in the current season in the Central Farm was in five different fields rather widely separated from one another.

35. The question to be considered is, if it is necessary for every crop to have specialist doing work only on that crop or a group of crops. In the present case, it has been found that the Cotton and Millet Specialists have evolved in the past useful strains by telling off one or more of their Assistants to carry on the selection in the pulses grown in rotation with their main crops. It appears that it would do to attach additional Assistants for this work to the staff of other Crop Specialists and the work co-ordinated under an officer stationed either at Coimbatore or at one of the Research stations

where large areas of pulses are grown in rotation. Elsewhere in this report we suggest the creation of regional crop breeders and under millets we are recommending a cheap method on such regional crop breeding work.

COTTON.

36. A separate research section was opened in 1920 when a whole-time Cotton Specialist was appointed to take up the improvement of cotton in the Province. At the same time, a Central Cotton Breeding Station was also established at Coimbatore. The present area of the Cotton Breeding Station is 87·05 acres comprising 33·44 acres irrigable red, 20·18 red rainfed, 26·69 rainfed black soil 6·74 acres building, roads and channel. The Cotton Specialist is also in charge of the cotton work in eight different regions, Hagari (Westerns), Koilpatti (Tinnies), Nandyal (Northerns), Siruguppa, Adoni and Narasaraopet (Kakinada), Palur and West Coast (Sea Island type). In each of these centres, a scheme partly financed by the Indian Central Cotton Committee is in operation and is in charge of an Assistant Cotton Specialist with a full complement of assistants and fieldmen (Vide Appendix II). Most of these schemes commenced work in 1949 with the material and data accumulated previously.

37. The main object of the cotton improvement work is and will be as follows. Owing to the acute food shortage in the country, the area under cotton during the war and thereafter decreased considerably. The normal area under different varieties of cotton and for the year 1947–48 is given below :—

	Tinnies.	*Cambodia.*	*Uppam.*	*Nadam.*	*White and Red Northerns.*	*Westerns.*	*Cocanadas.*	*Chinnapathi.*	*Total.*
Normal	599,833	468,580	18,940	8,400	151,480	587,070	103,100	5,620	1,943,023
1947–48	417,120	202,178	8,910	2,911	62,855	341,434	68,917	8,240	1,107,565

Apart from the reduction in acreage, the cotton supply position both quantitatively and qualitatively worsened with the partition of India in 1947. Pakistan (West Punjab and Sind) grows more of medium staple cotton. The dwindling carry over stocks, the expanding mill industry, the need to conserve dollars and sterling, the mounting spiral of price-rise in foreign cotton, and the demand for finer fabrics were sufficient pointers for drawing up a plan of self-sufficiency without at the same time encroaching on areas under food crops. Estimates placed the post-war needs of the Province at eight and a half lakh bales of lint per annum—the relative requirements of American and desi cottons being roughly equal—to meet the entire demands of the textile industry. Madras will then have to double her annual production, increase the output of quality cottons by three lakhs bales and convert all short staple desi into medium quality type.

38. The items of research pertain to nine different varieties of cotton, both long and short staple, grown in the several ecological

regions. The three main aspects of research are maximization of yield per acre, increase in production without affecting the area under food crops; and improvement of quality. Maximization of yield per acre is sought to be realized by (i) manuring the irrigated cottons and medium fertility zones in the unirrigated tract, (ii) inclusion of legume crops in rotation as mixtures with an application of phosphatic manures to overcome the adverse effect of sorghum grown before cotton; (iii) December planting of summer irrigated cotton in South Arcot to overcome boll shedding, (iv) early removal of sorghum stubbles in Coimbatore district, (v) the ridging and wider spacing of cotton (36 inches) as an anti-erosion and soil-conservation measures in the Bellary and Anantapur districts, (vi) breeding of type resistant to pests and diseases and with high ginning percentage and (vii) large-scale production of certified seeds and compelling their cultivation by legislation in selected regions.

39. The increase in the production of cotton through increase in area is sought to be attained by (i) growing cotton as mixture with chillies, groundnut or intercropping between coconuts, (ii) utilizing modan fallows and kumri lands in the West Coast, (iii) developing suitable short duration types for cultivation in the rice fallows of Tanjore and Godavari districts and (iv) encouraging the cultivation of perennials in home-steads, vacant lands situated in unhealthy locality and as hedge plants round orchards. All these schemes are intended to increase the cotton area without encroaching on food crops by utilizing lands otherwise fallow.

40. The quality improvement is proposed to be effected by (i) breeding for staple length of 1⅛ inches in irrigated hirsutums, (ii) and one-inch staple in unirrigated hirsutums and desi varieties, (iii) acclimatization of Sea Island varieties for coastal regions both as rainfed and irrigated crops, (iv) replacement or indigenous desi by acclimatized American and (v) substitution of short staple variety by medium staple cottons.

41. In the Cambodia area, Co. 2, Co. 3, Co. 4 and 4463—all departmental selections—are being grown. These strains are gradually being replaced by Co. 4/B-40 a multi-purpose strain with a high adaptability to a wide range of environmental conditions and resistant to black arm disease. It was isolated from a cross between Andres 12 (South African hirsutum) by Cambodia. It yields 900 lb. of seed cotton per acre and has a staple length 1⅛ inches with a spinning value of 44 s. In the Karunganni area K-1 is pure line selection from G. *arboreum forma indica* with 13/16 inch staple. This is being replaced by K-2 and K-5 two hybrid strains evolved from a cross between G. *arborium, forma indicum and cernum.* These two strains have wider adaptability to suit the pure uppam and mixed uppam areas in the Koilpatti tract. The largest area under any one cotton is Westerns (G. Herbaceum) H-1 strain in the Bellary, Anantapur and Cuddapah districts. A scheme to evolve a medium staple cotton for this large unirrigated area has just started. N-14 (arborium) type is grown in a limited area in

the Northerns area. G-1 for the Kakinada area is being multiplied for distribution. Two selections 336-B and 336-E possessing the desired combinations (viz., colour and staple length) and three other hybrid selections are under trial. Strain 881-F (neglectum) with 13/16 inch staple as against 10/16 inch of the local has been found suitable for the Mungari area of the Bellary district. In order to utilize hybrid vigour by colonal multiplication, experiments are in progress to raise a crop from cuttings of F-1 hybrid with the help of plant harmones. Preliminary experiments in fixing F-1s of outstanding merit by the parthenogenetic methid have been succeeful. Further trials are necessary to make practical use of this method. The trial of Sea Island cottons commenced by a Botanist (late Sri Subba Rao) ten years ago is being continued by the Agricultural Department in the West Coast Stations both in the open fields and under coconut trees by importing fresh seeds again directly from the United States of America. The lint produced gave 120 counts which is as good as commercial monteserrat (Sea Island) grown in the West Indies. Selected varieties *Moco* and *Quebradinho* of South American perennials have been found suitable for growing in the homesteads and as hedge round orchards. This will provide cotton for hand spinning. Firka Development Officers are being requested to encourage the expansion of the cultivation of these two perennial types. Stable hybrids between *G. taitense* and *G. dawinii* possessing desirable staple length and ginning percentage have been built up. These are under yield trials.

42. Unlike the paddy and millets growers, cotton cultivations do not keep their own seed for the next crop because the whole produce is sold to merchants as kapas (seed cotton). The cultivators invariably go to the bazaar for buying seed at the sowing time. This practice is unsatisfactory as they cannot get pure seed thus. Hence schemes for multiplication and distribution of the improved strains have been in operation with each release. There are now six large scale seed multiplication schemes financed by the local Government in operation in the Province. Nucleus seed is supplied by the Cotton Specialist to sow inner seed farms (Primary). Seeds from the inner seed farms are utilized for raising large scale outer seed farms from which bulk distribution is made to the farmers. These schemes are administrated by the District Agricultural Officers of the zone with the help of their Agricultural Demonstrators. Now that Assistant Cotton Specialists of gazetted rank entirely for work in cotton are appointed in each of the major cotton zones, it is desirable that the seed multiplication schemes are directly controlled by the Specialist's staff. This will ensure better care and vigilance in the rogueing and handling of the cotton in the field and ginneries before finally bagging the seed produce. The relative seeds should be sent in sealed bags to the Agricultural Demonstrators' depots for distribution.

43. In the opinion of the Committee, it is highly essential that greater stress should be laid on multiplication and distribution of

pure seed of improved varieties in sufficient quantities to cover the entire area. The Committee understands that a proposal to introduce Cotton Control Act is already under consideration of Government. In the opinion of the Committee, this Act should be brought into force at an early date. In this, the Government's responsibility to multiply and stock sufficient pure seed of improved strains and make them available well in advance of the sowing season becomes all the greater.

OILSEEDS.

44. The oilseeds section was opened in 1930. The Oilseeds Specialist took up the improvement of the four oilseed crops, i.e., groundnut, gingelly, castor at Tindivanam and Coconut at Kasaragod, Nileshwar II and III and Pilicode in South Kanara. In 1948 the Kasaragod Research Station was sold to the Indian Central Coconut Committee. The Oilseeds Specialist is helped by three temporary gazetted assistants. One is in charge of groundnut, gingelly and castor improvement work at Tindivanam, another is in charge of the Coconut Research Scheme of the Indian Central Coconut Committee at Nileshwar and the third is in charge of the coconut nursery scheme with headquarters at Coimbatore. The subordinate staff for this Research section dealing with four oilseed crops, one of which is a long duration perennial crop (coconuts) consists of 4 permanent assistants and 6 Farm Managers the latter of whom are liable to frequent transfers. This section like that of millets should be manned exclusively by research assistants. The superintendents in charge of these research stations have been kept on for nearly 10 years on a temporary basis. In the best interest of the research work these posts should be made permanent.

The area and production under four important oilseeds are given below :—

	Area. ACS.	*Production.* TONS.
Groundnut	3,742,840	1,616,450
Gingelly	718,020	84,950
Castor	280,880	24,250
Coconut	606,290	..
Other oilseeds	71,960	..

Groundnut is the chief exportable commodity of this Province. The present high price encourages the farmers to replace other crops with groundnut. The production of gingelly is short of the needs of the Province and has therefore to be imported from outside.

45. In groundnut, three strains T.M.V. 1 (A.H. 25), T.M.V. 2 (A.H. 32) and T.M.V. 3 (A.H. 698) are already under distribution. There has been a uniform appreciation for T.M.V. 3 for (i) its good round and well-filled kernels eminently suitable for drill sowing, (ii) its pod forming habit at shallow depths, and

(iii) high ' natural test weight of pods and higher shelling percentage. Nucleus seed is being multiplied at Tindivanam for supply to primary seed-farms in the district. Further reasearch during the period under review in this crop resulted in the isolation of five promising cultures of 100 days duration, two of 110–125 days and one culture for the rainfed tract possessing dormant habit of seed. These cultures are ready for district yield trial. In addition, strain A.H. 334 suitable for the irrigated condition and yielding 30 per cent more on the local has been released for distribution in the South Arcot district. A bunched groundnut strain with dormant seeds of the Spanish Peanut type grown extensively in Guntur and Pollachi areas has been evolved by hybridization This is also in final stages of trial in the cultivators' holdings. Work to evolve a strain of the large seeded type with low oil contents for edible purposes is under way. Manurial experiments on groundnut have shown that the application of potash and cattle manure is necessary to maintain good yields. Good tilth contributes to increased yield particularly in years of meagre and ill-distributed rainfall. Two weedings one at flowering time and another a month later contribute to good yields. Mixed cropping of groundnut is more remunerative than a pure crop of groundnut. Cereals following groundnut have given more yields than cereals following cereals. Setting up of light traps and dusting with DDT 5 per cent effectively controls the " Surul poochi " (*Stomopteryx nertia*). The damage through " Tikka leaf spot " disease is reduced by spraying $\frac{1}{2}$ to $\frac{3}{4}$ per cent Bordeaux mixture. Detailed studies on the storage of groundnut under a scheme financed by the Indian Council of Agricultural Research were conducted and concluded. These findings are published in the form of a leaflet for the benefit of the groundnut growers and merchants.

46. *Gingelly.*—As gingelly is a season bound crop strains suited to different seasons are being evolved. T.M.V. 1 and T.M.V. 2 are not suitable for irrigated condition. T.M.V. 2 is being multiplied as a short duration (74 days) type with high oil contents and light colour seed coat. It has also the additional advantage of partial dehiscence of capsules. This strain has also been found suitable for growing in dry lands after groundnut in winter in South Arcot district. T.M.V. 3, a hybrid strain records 50 per cent yield over the local as a summer crop and is earlier and comparatively more resistant to wilt and shoot webbing caterpillar, than the local. Spacing trials show that a spacing of 1 foot by 1 foot for irrigated crop and 9 inches by 9 inches for the rainfed crop is optimum. A seed rate of 4 to 5 lb. should, therefore, be sufficient to ensure the optimum stand for a good crop. It has been found that the best time to harvest gingelly crop to avoid shattering of the grain from over-maturity is to harvest the crop when the pods show signs of yellowing. This does not affect the quality or percentage of oil extracted. The " little leaf " disease (Virus), which is a serious disease in the local gingelly varieties

is being tackled by hybridizing the local strains with two exotic resistant types " Entebbe uganda " and " Malan ".

47. *Castor.*—Co. 1, a strain isolated from a perennial type of castor is rich in oil (55 per cent) and is in demand from rubber and coffee planters. In regional trials T.M.V. 1 was found suitable for the Ceded districts, T.M.V. 2 for Salem and T.M.V. 3 for the Nellore district. Castor yield is best when plants are spaced 3 feet each way. Spacing less than 3 feet delays flowering and reduces yield. Studies in the harvesting and curing of the capsules showed that the local method of harvesting, when the top capsules dry and fermenting the head for a week before threshing reduces the percentage of oil and increases the free fatty acids. The best method is to harvest the head when capsules show signs of drying and dry them in the sun immediately on a threshing floor. Fortunately most of the strains do not split open in the field even when dry.

48. *Coconuts.*—Madras is the only province, where research on coconut has been taken up and is being continued. The Province is eminently suitable for work on this crop both fundamental and of applied nature. The oil-seeds section has been making intensive study of the coconut palm from 1930. As a result of this long and intensive study, it was possible for the section to gather valuable information on the life-cycle of the coconut tree, as also on the various aspects of coconut cultivation and production. All such information has been utilized by the Department and the Indian Central Coconut Committee for demonstration and propaganda among the coconut growers of India. It is difficult to achieve quick results in coconut within a period of five years. Some of the important findings suitable for adoption by the coconut growers are given below. Regular inter-cultivation of coconut gardens even without manuring improves the yield of the plantation. The best manurial schedule for the coconut palm has been found to be 4 lb. of ammonium sulphate and 20 lb. of ash with a green manure crop sown in the pre-monsoon and ploughed with the break of the north-east monsoon rains. The best green manure crop for coconut is *Crotalaria striata* (wild sunnhemp). Seed of this green manure crop is being multiplied for distribution in the West Coast. The beneficial effect of burying of husks and leaves of coconut in trenches 15 inches deep between the rows of trees bothways is found to last for about 6 to 8 years. Raising of subsidiary crops in coconut gardens does not affect the yield of coconut. Dry paddy, varagu, tapioca, pine-apple and cotton are found to do well in a coconut garden. Harvesting of immature nuts for oil extraction is uneconomical. Study of monthly variations in the oil contents of copra showed that nuts harvested during summer are the most suitable for copra-making and nuts harvested during colder months are better disposed of as whole nuts for local consumption. Investigation on the quality of coconut fibre showed that it is economical both from the view point of fibre quality and

percentage of oil, to harvest coconut when they are eleven months old. Studies on the analysis of copra and oil samples from different coconut growing areas were conducted to fix grade standards. A detailed study of the economic characters of the exotic varieties of coconut which have come to bearing, show that varieties Laccadive ordinary, Laccadive small, Andaman ordinary, and Cochin China are suitable for large scale propagation and introduction. The study of the vegetative characters of the seedlings raised from nuts obtained by natural cross and self-pollination from trees of different yield groups has shown that seedlings obtained by self-pollination or from trees yielding 40 nuts and below per year are the least vigorous. They are, therefore, unsuitable for propagation. Extensive hybridization work both inter and intra-varietal has been done in the coconut with a view to produce economic types. Unlike other crops, the study is very complicated as the varieties themselves are not homozygous. The object of raising a number of F_1s is to find out which F_1 combination gives the largest number of useful types so that future selection may be confined to that progeny. Thick girth of the plant has been noted to be correlated with early and prolific bearing. Early splitting of the leaflets in a seedling has also shown a similar correlation and these make it possible to select desired types in the seedling stage. We found in the coconut nursery at Pattambi, seedlings which were said to have been rejected based on the usual tests conducted from germination to the full seedling stage. Such seedlings would obviously be sold by commercial nursery-men. The process of selection now followed is (i) selection of parent trees based on the shape of the crown and number of leaves, (ii) selection of the best nuts from high yielding trees, (iii) selection of most vigorous seedlings. Right Government nurseries are now established to supply coconut seedlings of the best quality estimated at about 160,000 seedlings per year. We were informed at Samalkota that ryots prefer two-three years old seedlings to one year old seedlings now sold by the department, as pre-root-formation is found necessary to reduce the percentage of mortality in the transplants in these tracts. It is for consideration whether it is not advisable to supply two—three years old seedlings in conformity with the local practice.

49. As the coconut crop lasts about 100 years, it is very desirable that the records of the three coconut stations including plans be written with indelible ink on parchment paper and kept in a leather-bound book. Besides records of long duration plants like the coconut and fruit trees should be duplicated at the headquarters of the specialist.

FRUITS.

50. Regular research on fruits started with the opening of the Fruit Research Station, Koduru, in 1935 and the appointment of a Fruit Specialist. Later the fruit stations at Coonoor, Burliar

and Kallar were also handed over to the Fruit Specialist to work on hill fruits. Recently fruit growing has been started at the Ambalavayal farm in Wynaad. The Banana Research Station was opened at Aduturai in April 1949. In addition to these Research stations, nursery work is in progress at Anakapalle, Lam Agricultural College, Coimbatore and Taliparamba Agricultural Research Stations.

51. The Fruit Specialist has his headquarters at Madras where a Diploma and a Certificate Course in Horticulture to train agricultural demonstrators and fieldmen respectively are conducted. The Fruit Specialists is helped by an Assistant Fruit Specialist at Madras and a second Assistant Fruit Specialist is in direct charge of Hill Fruit Stations and a third Assistant Fruit Specialist of the Banana Research Station, Aduthurai. Stations at Kodur and Wynaad are under the charge of Superintendents. The Fruit Specialist has to deal with a large number of fruit crops most of which are perennial and therefore the research work has to be carried on on long-range basis. The existing research stations are, therefore, being utilized for the conduct of the most important long-range investigations intended to secure results of practical value to the growers or to acquire basic knowledge on fruit trees and their culture. The chief items of investigations are—

(*a*) Varietal trials,

(*b*) Bud selection and clonal progeny tests,

(*c*) Propagational studies,

(*d*) Root stock selection,

(*e*) Cultural practices,

(*f*) Cropping tendencies including blossom, biological and pollination studies,

(*g*) Hybridization of the mango,

(*h*) Research on vegetable, and

(*i*) Classification and nomenclature of the fruit plants.

52. *Mango.*—A survey of orchards combined with a detailed survey of their efficiency has been carried out. Trees with inherently high performance and quality are marked. Variety trials have been laid out. Superior and remunerative varieties of mangoes are now propagated. The classification and nomenclature of mango varieties have been completed. This work has a great bearing on nurseries which henceforth will be regulated by legislation. Another important research item that has been successfully carried out is the hybridization work by which characters of different varieties are attempted to be combined with a view to evolve an ideal mango with a set purpose. Some hybrids have already caught the fancy of mango growers on account of their heavy bearing. Root grafting of mango which is an ingenious device is another useful work which stands to the credit of this

section. Studies on the relationship between growth features and cropping which is connected with the problem of biennial bearing of mangoes has been in progress and the control of fruiting tenancy of this crop is well within sight.

53. *Citrus.*—The economic value of establishing budded lime plantations on an efficient and accommodating root stock has been demonstrated. A difference in cropping of as much as ten times was found to exist between seedling limes and limes budded on *Gajanima* at one stage. Rootstock trials in the case of sweet orange have been laid out on an extensive scale. Budding on citrus stocks has proved successful, that nearly one hundred and fifty new nurseries have sprung up in the province. High yielding trees in citrus varieties have been selected. Vast spread of citrus cultivation outside the Koduru area is due to the work done at Koduru. Improvement of orchard practices has been secured by the widening of irrigation basins and application of the right manure, as a result of careful study of citrus root system.

54. *Other fruits.*—The selection of promising varities of sapota and guavas, introduction of phalsa and the evolution of clonal strains of high performance in cashew, jack and custard apple are other items on which useful work has been done. Yema grafting in grapes and side-grafting in figs and sapotas have been popularized. A careful selection of early mid-season and late varieties of important hill fruits such as plums, apples, peaches and pears has been made and grafts are distributed to the tune of 30,141. Rootstock trials have also been laid out. Selection work in strawberry and cape-gooseberry has shown the possibility of evolving high-yielding clonal strains. Large scale multiplication of this material is on hand. Work on the application of harmones has given good results. Mangosteen and jack have been successfully propagated by vegetative methods. Application of a linseed oil emulsion as spray has resulted in early and heavy bearing in apples.

55. The practical utility of fruit research is shown in several ways. Over one hundred and fifty new nurseries on modern lines adopting the technique evolved at Koduru have sprung up all over the province. The Government nurseries are flooded with orders and some of these are being registered for compliance after two to three years. So far 91,380 fruit plants have been distributed from the Fruit Research Station, Koduru, alone. The fruit growers all over the province have come to realize the value of variety, tree selection and the latest cultural practices and these are gradually changing the complexion of the fruit industry to the good of the province, as a whole. Amongst the leading commercial fruits, sathgudi has received an impetus to such an extent as to occupy double the area of that four years ago.

56. The Committee definitely hold the view that the future improvement of fruits demands extension of hybridization work to

all fruit crops. Land facilities for progeny tests of controlled crosses should be provided. It would be advantageous to have properly trained horticultural personnel for effectively passing on the results of research to the fruit growers.

To meet the needs of the fruit-growing regions of the whole province, the establishment of regional fruit research stations to tackle local problems is very necessary. The Committee understand that there is a scheme to establish regional research stations and recommended the scheme for sanction. These can be linked up with the proposed model orchards which would form effective visual demonstration centres.

57. The Committee are also of opinion that all horticultural research work should be brought under one control and grouped as follows :—

(i) Hill fruit crops such as apples, peers, plums and vegetables, potato, cabbage, cauliflower, etc., and other temperate and sub-tropical fruits and flowers as well as spices; in short all fruits that grow on the slopes of hills upward to the highest elevations

(ii) Plain fruits and vegetables such as mango banana citrus, grapes, etc., and chillies, brinjals, cucumbers, etc

(iii) Fruit preservation.

The Committee observe that no work of any economic importance is being done on vegetables. The Committee strongly feel that steps should be taken to devote special attention to the growing, extension and improvement of common fruits such as guava, pomogranates, zizyphus, custard apple, etc., so that cheap fruits in plenty would be available for the common man.

58. The merging of various scattered horticultural activities into one section will prevent the disproportionate and uncordinated development of work as seen now in horticultural work in the province and will permit the exploitation of the talents of workers in each specialized field. Compared to the present system, it will also provide opportunities for deserving workers to secure higher status and position which is at present denied to them when they are distributed under different administrative heads unconnected with each other.

SUGARCANE.

59. Research on sugarcane was first initiated at Samalkota in 1902. Later, sugarcane research was started at Palur and Anakapalle to study regional problems and to test the canes released from the Sugarcane Breeding Station at Coimbatore. In 1935, another station, with the financial help of the Indian Central Sugarcane Committee, was opened at Gudiyattam. Recently the Agricultural Research Station, Anakapalle, was converted into a Central Sugarcane Research Station for the province with a full complement of staff consisting of a Sugarcane Specialist, Assistant

Chemist, Mycologist, Agronomist, Plant Pathologist and Assistant Entomologist with two research assistants for each of them. Among the sugarcane varieties, Co. 419 holds the sway throughout the province except in the Nellikuppam factory area where Co. 281, Co. 349 and P.O.J. 2878 continue to be cultivated. Recently in the sugar factory areas of North Visakhapatnam and Vuyyuru (Krishna district), the authorities of these two factories are insisting on the cultivation of Co. 527 as a rich cane for early milling though not as good an yielder as Co. 419. Some of the promising canes under trial at the various research stations are Cos. 471, 449, 447 and 475. Consequent on the opening of liaison farms in the four factory areas at Samalkota, Hospet, Nellikuppam and Pugalur and centralizing the sugarcane work at Anakapalle, work on this crop at Samalkota and Palur has rightly been dropped. During the period under review optimum dosage of nitrogen for cane has been worked out for centres like Anakapalle, Samalkota, Gudiyattam and Palur. Ryots are advised not to use more than the recommended dosage and in the form of a mixture of organic and inorganic nitrogen in the ratio of 2 :1, half at planting and half at the first earthing up. Further fundamental research on the up-take of nitrogen during the growth of the crop through periodic analyses of the plant and soil to ascertain the best time or times to manure it is in progress. One of the tentative findings is that it is useless to manure the sugarcane crop at planting. The ratoons are said to show a lower level of nitrogen in their soil even when normally manured as compared to a plant crop. Organic non-sugars and moisture by sucrose ratio would appear to determine the quality of gur. The Sugarcane Plant Physiologist is studying the water intake in cane by irrigating the crop at 12, 18 and 24 days intervals. The water let in is quantitatively measured by the V notch method. The moisture content of the soil is kept at the same level at the end of each irrigation and approximating to 10 per cent moisture in the soil. It is found that the degree of soil moisture can be judged by the feel of the soil with the fingers for stickiness. If the moisture is kept up as above no difference in yield is noticed.

Attempts are also made to correlate the moisture holding capacity of the plant tissue in sugarcane with its sucrose contents. The cane leaves of ratoon plants are found to be less efficient in functioning than those of a plant crop. Some of these items of research though approved by the Central Sugarcane Committee would appear to be more of academic interest.

60. In addition to the Sugarcane Research Scheme, a Sugarcane Development Scheme has also been sanctioned by the Indian Central Sugarcane Committee. A special Agricultural Demonstrator under the direction of the Superintendent of Liaison Farm is posted to each of the 24 tauks where sugarcane is largely grown to step up the acre yields by active propaganda for the adoption of improved cultural and manurial practices recommended by the

department. The staff helps in securing necessary materials and equipments for cultivation and *Gur* manufacture and taking timely action against pests and diseases. It is too early to judge the result of this Development Scheme, as it came into operation only in April 1949.

POTATO.

61. Research on potatoes is carried on at the Agricultural Research Station, Nanjanad, under the charge of a temporary Superintendent assisted by three Farm Managers. The following experiments are in progress :—

(i) varietal trials, (ii) seed sprouting experiments, (iii) soil erosion studies, (iv) testing mature *versus* immature tubers for planting, and (v) rotational, manurial and pathological experiments.

Great Scot is the only variety that is now cultivated over 20,000 acres. Three crops of potatoes are taken in the Nilgiris, the planting being done in May, September and in February. Difficulty is usually experienced to find adequate seed for planting the September crop. The seed from the May planted main crop had to be frequently used for planting, but this does not get enough resting period. Unless this dormancy is broken, the fresh tubers are not fit for planting. To get over this difficulty, it was found after series of trials, that treatment with carbon-di-sulphide helps to break the dormancy of potato tubers. It costs only two rupees for treating seed for one acre and has been taken up by the potato cultivators. Planting of potato along the contours according to the farm method is being advocated. The extension of this practice as well as the growing of a green manure crop is limited by the fact that agricultural operations in this area are carried on by manual labour. The Nanjanad manure mixture evolved at this station is being adopted by the potato growers. But this involves heavy expenditure to the growers because of the large quantities of manure used. Comprehensive manurial experiments for the purpose of reducing the manure bill have been laid out in consultation with the Director of Potato Research, Government of India.

Although, the acreage under this crop is small yet it has a great economic value to the peasant of the Nilgiri hills owing to its heavy yield per units area. Secondly it is an important cash and subsidiary food-crop. The Committee are of opinion that the present research station should be raised to the status of a Potato Breeding Station with necessary staff and equipment to deal with breeding and agronomic problems. Seed certification scheme for potato should be brought into force to ensure the distribution of disease-free seed for planting.

62. Nanjanad being the only potato research station for the province, it is very necessary that the post of the Superintendent is made permanent, and the subordinates are classed as research

assistants as in the case of other crops to maintain continuity of work and prevent their frequent transfers. This station is under the administrative control of a Deputy Director of Agriculture who is also liable to transfer. It is desirable that the Superintendent is guided by a crop breeder from Coimbatore, who is more permanent in his work than a District Officer like the Deputy Director. The Director of Potato Research to the Government of India is of the opinion that Great Scot may not be the last word for Nilgiris conditions and that breeding under local conditions might yield *more suitable types. It is necessary to intensify the breeding work* in potatoes at this station.

CARDAMOM.

63. *Scheme of scientific aid to cardamom crop.*—Cardamom was once a flourishing crop of South Indian hill ranges growing almost wild in the forest at an elevation of 2,500—3,000 feet. This grows easily in the forests without any hindrance to the forest trees. It is a shallow rooted crop thriving on the leaf mould and other vegetable debris always available under forest trees. The crop needs no digging of soil but only occasional removal of weeds by sickles. Travancore has the largest area (60,000 acres) under cardamoms and Madras Province only 15,000 acres. Ninety per cent of the produce is exported to foreign countries. Of the 10 per cent consumed in India, only 2 per cent is utilized in the province. As cardamom grows easily under natural conditions, planters did not bestow necessary attention to the crop, with the result that in recent years, pests and diseases appeared *and took a heavy toll of it. The quality of the produce* deteriorated and the yield dwindled from an average of 100 to 35 lb. per acre. Consequently many plantations were abandoned as unprofitable. To rectify this deplorable state of affairs, the Indian Council of Agricultural Research sanctioned in 1944 a scheme of scientific aid to improve the yield of the crop by breeding and control of pests and diseases. The Burma Trading Corporation, which is interested in the crop, readily and kindly provided lands and buildings for opening the research station in the Singampatti hills. It has now run for five years and a second extension has been sanctioned for a further period of five years from 1949.

64. During the first five years, a good collection of various types of cardamoms grown in the different hill ranges was made and selection and hybridization commenced. Twenty pure lines combining high yield and quality of pods with desirable characters are now in field trial. Some of them have given cent per cent increase yield over the control. On the entomological side, the efficiency of periodic dusting of B.H.C. (Gammexane D. 025) or Nicotine sulphate spray has been demonstrated and planters are readily taking to these control measures. The chief diseases of cardamom are stem rot and mosaic. Application of Ammonium phosphate and Superphosphate controls the "*Katta*" disease caused by Pythium. The loss in the nursery has been minimized by improving soil texture, addition of wood ash and providing

artificial shade. The yield from plantations regularly adopting the recommended methods is on the increase and the proportion of scabbed pods has been reduced to a negligible figure.

65. Being a perennial crop, the benefits of breeding will take some years to be realized. The scheme is recommended for continuance providing necessary amenities to staff on the same scale as is given by well organized hill planters, so that the scientific staff may carry on the work enthusiastically.

Botanist Section—Lecturing and Systematic.

66. The botanical teaching at the Agricultural College is of sufficient importance and occupies sufficient time in the scheme of teaching as to necessitate the employment of a well qualified Botanist. There is, however, no Research Section in General Botany at the college as the botanical work on crops has been entrusted to crop specialists. The Madras Herbarium, which was with the then Government Botanist in Madras, was shifted to Coimbatore Agricultural College, when the office of the Government Botanist was shifted to Coimbatore. The Lecturing Botanist who succeeded the Government Botanist in teaching took charge of the Herbarium. He was also then entrusted with the organization and maintenance of a botanical garden. The important items of research work on hand since 1944 are (1) studies relating to the botanical survey of Ramnad and Tirunelveli districts, (2) economic studies of fodder grasses and legumes, (3) collection of green manuring plants suitable for crops, weeds and medicinal plants and (4) seed testing for the departmental officers.

67. The botanical survey has resulted in locating regions where useful plants grow. The collection of plants of possible insecticidal properties as Derris, Ruta, *Milletia muncluea*, etc., has been made. Among the notable results of the study of the various grasses collected are the introduction of *Panicum antidotale*—a drought resistant grass—giving 15,000 lb.—30,000 lb. of fodder per acre in 3 to 5 cuttings according to the rainfall conditions. *Brachiaria mutica*, otherwise known as Buffalo grass, is suitable for marshy lands. *Cyonodon plectostachyum* (Giant Star) grass, which is a good surface soil binder is now in demand by the railway authorities and Public Works Department for planting the canal banks and track embankments. *Pennisetum polystachyon* is a good fodder grass for the West Coast. This section has done some valuable work on plantains. A monograph was prepared and awaits publication.

68. The Committee feel that with the present strength of staff and their equipment, it will be difficult for the Systematic Botanist to maintain Herbarium in the manner in which all Herbaria should be maintained and developed. The Committee is informed that the present Lecturing and Systematic Botanist Section represents portion of the activities of an organized Systematic Section, which

has since been abolished. The Committee is of opinion that for getting the best out of the present section, its activities should be delimited to definite items. The activities of this section should in future be confined to the collection of weeds of farm crops and gardens and study of their life cycle and methods of their natural spread with the object of developing suitable control measures. This work should obviously be carried in full collaboration with the departmental experiment stations who should render help, including the trial of weed-killers and cultural methods. Besides the above, this section should continue to collect, grow and multiply, if necessary in small plots, plants that are likely to be useful in the preparation of insecticides and fungicides from locally grown plant material. In the matter of medicinal plants this section should aim at getting the full co-operation of the Indian School of Medicine and institutions like the Central Drug Institute at Lucknow for further developing the work to the production of pharmaceutical preparations. Regarding the development of indigenous insecticides and fungicides, the Committee feel that the country is now in a week position having to import most of them from abroad. In this work the other sections at the college including that of the Agricultural Chemist, the Entomologist and Mycologist should co-operate in the preparation and of trial of these products. Seed testing work should be continued.

CYTO-GENETICS.

69. The Cyto-genetical work at Coimbatore was started in June 1946, with a view to help the plant breeders to solve their cytological problems and if possible to act on the nucleus mechanism for evolving new or desired crop types. Later on the Cyto-geneticist at Bapatla was also transferred to Coimbatore, where the demand from Crop Specialists was too much for one Cyto-geneticist. The two Cyto-geneticists are under the Principal. Each is entrusted with work on certain crops and is helped by one Research Assistant. They are at present developing the Cyto-genetic technique—the first need in all such work. An attempt is being made to influence the Chromosome structure of the plant. Deploid cumbu has been crossed with the tetraploid—Napier grass—and has given a perennial triploid which was found sterile. An ampidiploid has been obtained from this by Colchicine treatments. The Napier grass is both drought and rust resistant. As rust is very common on cumbu, it can confidently be expected that this would lead to Bajri (cumbu) types resistant to rust disease. The primary hybrid by itself is promising as a fodder crop that could be propagated by slips and cutting like sugarcane. Several wild species of cultivated crops are being collected, and studied with a view to crossing them with cultivated types. It is necessary to emphasize that all work in this section should be strictly confined to economic plants.

70. The second Cyto-geneticist is dealing with problems relating to paddy, gingelly, pulses and sweet potatoes. The work on

sweet potato, particularly the collection of varieties and raising of hybrid progenies might prove a useful line of work in securing sweet potato types that could be cultivated, in any season and the evolution of short duration types for growing after paddy in the deltaic tracts thus augmenting available food supply.

71. In the opinion of the Committee, it would be advantageous to enlarge the activities of the section to cope with the demand from the crop breeders. As work developes extra Assistants may be added to the section, earmarking them for particular crops, if the work justifies. The addition of an X-ray unit is necessary. The work at this section makes it eminently suitable to take students for post-graduate studies.

BOTANICAL GARDENS, OOTACAMUND AND COONOOR.

72. These two gardens are chiefly meant for the use of the students of botony, introduction of exotic ornamental and economic plants, multiplication of flower plants and also to serve as pleasure parks. The staff at these gardens consists of one Curator and three Assistants.

Efforts till now in the direction of ornamental gardening and use of cut flowers for decoration and floral designs have indicated the scope for developing the floral industry, particularly in the Nilgiris as evidenced by the numerous indents for ornamental plants, seeds, bulbs and cut flowers from many parts in India. It appears that these gardens are unable to meet the demand.

73. The maintenance of these gardens at a high level of reputation to serve as real pleasure parks is also essential. The Committee suggest the following lines of work :—

(i) Research on floriculture with a view to improve the quality of existing types of flowers, which are grown for sale in the market; and

(ii) selection, propagation and distribution of sufficient planting material of certain economic plants such as peppermint, *Thymus vulgaris*, scented geranuium, Helictrope, narcissies, etc., for extraction of essential oil and perfumes. This will require co-ordination with the Industries Department and the Agricultural Chemist. These lines of work will improve the utilitarian aspect of these gardens.

74. The Committee observe that these two gardens are serving the purpose stated above. But it is generally felt that at these gardens, some useful research work could also be done. It is observed that an attempt was made to study the economics of medicinal plants on a field scale but this work was stopped due to lack of facilities. In the opinion of the Committee, these gardens should be brought under the control of the proposed Horticultural Section along with fruits, fruit preservation, etc.

Plant Protection.

75. Researches in Plant Pathology or (the " Science " of dealing with the protection of crops from pests and diseases) are undertaken by the Entomology and Mycology sections. In the past, the heavy work at headquarters made it difficult for the limited staff to attend to timely control measures against pests and diseases in the districts. Government have recently added two Assistant Research Officers to each section to carry on large-scale plant protection in the districts. In each district, two Plant Protection Assistants are working under the District Agricultural Officer to deal expeditiously with outbreaks of pests and diseases. Each of the Assistant Research Officers direct protection operations in twelve districts. It must be said to the credit of the officers concerned that the Plant Protection staff though only ten months old, had done commendable work and been able to control large-scale incidence of pests and diseases. It will be seen that as much as 181,303 acres were protected within the last ten months. (Appendix III and IV.)

Entomology.

76. The Government Entomologist has besides his laboratory, an Insectory and Apiary at Coimbatore. He has also taken up special investigations at the following centres :—

Fernhill and Kodaikanal—Biological control of Icerya; Nellikuppam—Biological control experiments against sugarcane borers; Aduthurai—Investigation of paddy pests, mealy bug, stemborer and rats; Wynaad—Orange borer scheme; Razole and Narasapur—Coconut caterpillars; Panyam—Ber fruit fly; Siruguppa—Cholam fly; and Tadepalligudem—Paddy gall fly.

The chief lines of research are : Study of the life history and habits of the insects affecting crops, livestock and household pests and evolving suitable control measures and extension of bee-keeping in the Province.

77. Consequently on the availability of the two wonder insecticides D.D.T. and B.H.C., certain outstanding developments in pest control have taken place during the 1948 and 1949 necessitating the re-orientation of some of the previous methods. The following pest control measures utilizing the new insecticides were tested and passed on to the Pest Protection Officers in the district :—

Paddy : Swarming caterpillar paddy grasshoppers and the rice bugs are controlled by B.H.C. and the Jassid with D.D.T. Cholam and other dry crops : Different species of grasshoppers affecting them could be brought under control by B.H.C. and D.O. 25. The same insecticide was found effectively against red hairy caterpillar.

B.H.C. spray has proved efficacious against garlic and onion thrips, agathi, stem weevil and betel vine bug which could not effectively be controlled so far; the field rat extensively damaging rice crops both in the nursery and in field and sugarcane is now under check. The demand for this chemical (zinc phosphide) could not be met with, as all the available stocks in India has been utilized. The cost of the insecticide required per acre is Re. 0-8-0 compared to Rs. 10 previously spent for effectively catching the rat throughout the season. A special technique for the fumigation of large stocks of foodgrains stored by the Civil Supplies was evolved. The work is in charge of a special vigilance staff of four Assistant Entomologists and their assistants.

78. Investigations are in progress on the following pests :—

The paddy stemborer; the paddy mealy bug; the paddy gall fly; the stripped bug of paddy, the cholam earhead bug and the cholam stem fly.

Control measures are being investigated against ber fruit fly, the pomogranate butterfly and the mango hopper. Under the category of biological control, successful results have been obtained against cottony cushion scales, the coconut caterpillar, and the apple woolly aphis and parasite. Breeding centres are in operation for releasing predators. The utility of Trichogramma release is being tested against the sugarcane borer, cotton boll-worms and the potato tuber moths. The predator Rodilia is very helpful in controlling the spread of cottony cushion scale on orange (5,000 acres) and wattles (15,000 acres) in the hill districts. The continuance of this scheme of control is essential, because of the danger of the pest taking to other crops like coffee, tea and potatœs; continuous vigilance is necessary in this regard. Some interesting results have also been achieved in utilizing indigenous vegetable poisons as insecticides. The Committee understand that good progress has been made in the popularization of bee-keeping as a cottage industry. There are about 7,000 hives maintained in the Province. The Committee have gone through the scheme for further research on honey bees and considers it worth encouragement. Two Indian Council of Agricultural Research scholars have been working on reviewing literature relating to two families.

79. It is suggested that research in the section may continue with special attention to the following items :—

Intensive research on pests of paddy like stemborer, mealy bug and gall fly to evolve satisfactory control measures and biological control studies of parasites and predators of crop pests. The Committee learn that an officer of the department specially trained in this work in U.S.A. is available.

80. Although the Committee generally approve the programme of this section, they would stress that the section should intensify their investigations on indigenous insecticides which would be cheaper and more readily available than the imported materials. Besides this, it is suggested that greater attention should be paid towards manufacture of dusting and spraying equipment at prices within the reach of farmers. This should be done in close collaboration with the Agricultural Engineering section and Indian manufacturing concerns like the P.S.G. & Sons' Charity and Industrial Institute and Kirloskar.

MYCOLOGY.

81. The Mycology section deals with diseases of crops caused by fungi, *bacteria or virus*. The headquarters of the Mycologist is at Coimbatore. He is also conducting special investigations in the districts in the following centres :—

Rice Research Station, Buchireddipalayam, on blast disease; Singampatti on cardamom diseases; Kotagiri and Wynaad on orange diseases.

82. The various items of research on which this section is engaged are given below. A survey of the incidence of the rusts on wheat in the Nilgiris indicated the resistance of local samba wheat to black rust. The view that Nilgiris forms the focus of infection to the wheat crops in the plains of India is found disputable from data collected by the section. All the same the Pest Act prohibiting the cultivation of wheat from April to September on the hills of South India under the direction of Central Government is being rigorously administered. As this measure curtails the available food supply in the Province, the matter needs to be taken up with the Centre. Grain smut of cholam is controlled by treating the seed with sulphur at a cost of three pies *per acre*, and ryots have taken to this treatment on a large scale. Annually 50 tons of sulphur are being distributed for treating cholam seed which will cover two and a half million acres of cholam crop. The study of long smut has proved that infection is through flowers when still inside the boot leaf. All species of sorghums are found susceptible to rust. The relative resistance of large number of cumbu and tenai varieties to rust was recorded and a complete life history of cumbu rust worked out. Brinjal has been found to be an alternative host. No strains or variety of ragi has yet been found to be resistant to *Piricularia* (blast) disease. Detailed investigations on Orobanche (broom rape) on tobacco were conducted. The seeds of the parasite remain viable for about 2½ years. *Capsicum annum* roots stimulate the germination of seeds of orobanche, but are luckily not themselves parasitised. Cultivators are, therefore, advised to grow tobacco after chillies and remove the orobanche as they appear in the crop. Damping off disease in the tobacco nurseries, which is very common and wipes out whole nurseries has been checked by regularly spraying 1 per cent Bordeaux mixture once a fortnight from the 20th day, after sowing, at 500 gallons per acre. Such treatment results in a saving of Rs. 1,500 per acre of nursery. Black arm, the serious disease of American cottons, is under study. Seed treatment controls only primary infection. Selection of resistant cotton varieties in collaboration with the Cotton Specialist is in progress. Smut on sugarcane has now become widespread in some tracts and is being controlled by applying the Pest Act and advising the cultivators not to ratoon more than once. Sugarcane like Cos. 605 and 601 were found to be resistant to mosaic. The occurrence of virus disease of potato in the Nilgiris has been established and can be checked only by distributing

disease-free certified seed. It is high time that a scientifically controlled seed multiplication station for potatoes is developed to distribute disease-free seed. Otherwise the production of potato crop in the Nilgiris is bound to decline. " Water cores of turnips " has been found to be due to boron deficiency and is easily checked by the application of 5—10 lb. of boric acid per acre before planting. Similarly, the " club-rot " of cabbage is controlled by the application of lime at 3 tons per acre to the soil combined with additions of mercuric chloride to the seed-bed and planting holes at a cost of seven rupees per acre. Studies on fusariosis (wilt) of brinjal, chillies and cluster-beans are in progress. Folioceliosis (yellowing) in orange could easily be controlled by two sprays of zinc sulphate and lime mixture per annum on the foliage. Results on the deterioration of the mandarine orange trees in Wynaad, Nilgiris and Shevroys indicated that it is due to low fertility coupled with soil erosion. Spectrographical examination of the leaves showed deficiency of manganese, magnesium, phosphorous, zinc and boron in affected trees. Further research is in progress in this direction. The two mildews of grapes are effectively controlled by repeated spraying with Bordeaux mixture, while the mildew on mangoes is satisfactorily checked by dusting with sulphur. Rhizome-rot of ginger is prevented by steeping the rhizomes in 0·1 per cent mercuric chloride solution before storage. Experiments on the control of canker, root-rot and die back in Cinchona are in progress. The Mycologist has made a standard preparation (Agri-Tree Killer) for effectively dealing with trees growing in unwanted situations. Two Indian Council of Agricultural Research scholars completed reviewing the literature on Pythiacaos fungi and Phanerogamous parasites. On the systematic side, the collection and identification of fungi of Madras were continued. An annotated list of the identified fungi of the Province is under preparation. Among the edible fungi, the cultivation of mushrooms in paddy straw has been standardized and demonstrations of its cultivation are being conducted.

83. It is observed that most of the remedial measures advocated as a result of the investigations of various diseases are adopted and farmers are reaping considerable benefit. Some of these measures such as spraying against mahali disease in arecanut, grapevine mildew, deficiency disease of citrus are being followed as a routine practice in large areas by the planters themselves.

84. The Committee suggest that the work on cereal rust, virus diseases, diseases on citrus, vegetables and deficiency diseases should be intensified.

AGRICULTURAL CHEMIST SECTION.

85. The Agricultural Chemist Section is one of the oldest and the largest section. There has been considerable expansion in the strength and activities of the section during the last two decades. The Agricultural Chemist is assisted by seven Assistant Chemists

of gazetted rank and 25 Research Assistants. Items of research are divided among the Assistant Chemist with upper subordinates working under them and include analytical and advisory work, teaching, soil physics, Plant nutrition and manures, Plant Physiology and Microbiology. An Agro-industry, viz., the Malt Factory at the Institute is also run by the Government Agricultural Chemist.

86. The analytical activities of this section include those on soils, manures, food and feeding stuffs, water, plants and plant products. Based on the results of these analyses, suitable advice is tendered to the concerned parties. The services of the section are being freely availed of by ryots, officers of the Agricultural and other Government departments, fertilizer manufacturers and dealers and the general public. The work has considerably increased in recent years on account of the initiation of fundamental research on paddy nutrition and nutritive values of rice, analysis of manures for quality control and of soils and irrigation waters in connexion with Grow More Food schemes. Besides, considerable time of the section is devoted to teaching. The Government Agricultural Chemist is carrying out field experiments at the Central Farm and in the Agricultural Research Stations at Hagari, Siruguppa, Nanjanad, Koilpatti, Pattukottai and others. Below is a review of research in progress for the last five years under respective headings.

87. *Soils.*—Studies on the distribution of soil moisture at Hagari were made to determine the effects of local methods of tilling with guntaka (blade harrow) as compared to ploughing with an inversion plough. No significant differences were found. The local practice of passing guntaka on the surface is satisfactory and serves to conserve the available soil moisture. Similarly, the effects of season and different cultural operations on soil tilth as measured by aggregates distribution in both red and black soil with ten treatments were studied. The results show the attainment of maximum surface area for plant roots in red soils by November when cultivated to medium or shallow depths. With deeper cultivation, this was reached much later in January. In the black soils, on the other hand, all the plots reached the maximum surface area by November. The standard treatment of ploughing once with Victory plough and once with country plough was found most effective in pulverising the soil. Run-off and soil erosion studies are in progress at Hagari and Nanjanad. At Hagari bare fallow suffers less from soil erosion than cropped land. At Nanjanad in the hill slopes, grass-covered plots proved most satisfactory for checking soil erosion and water losses. The farm method of cultivation with cattle power along contours is found to be superior to ryot's method of cultivation by manual labour across the contour and consequential propaganda is in progress. However, the spread of the farm method is limited on account of the dearth of work cattle in the hills. The surface run-off increases fivefold in 1:5 gradient as compared to 1:10 gradient. Grass-covered plots effectively check the run-off in both

cases. In collaboration with the Oil-seeds Specialist, soil moisture determinations were made in the coconut gardens at Nileshwar in plots where coconut husk and leaves had been buried in trenches at intervals. The treated plots showed higher moisture retention in early summer, a useful soil condition for increased yields. Ryots are being advised to conserve the moisture in their gardens by regular inter-cultivation and ploughing in green manures. Irungu cholam has been known to depress the yield of the following cotton in the black soils of Tirunelveli. This so-called "Cholam effect" is found to be counteracted by growing indigo mixed with cholam and ploughing it in before sowing cotton. Experiments have now been laid at the Agricultural Research Station, Koilpatti, to ascertain the changes in physico-chemical properties of the black soils under different treatments.

88. Soil survey of the delta between the Gowthami and Vasista branches of the Godavari river shows that the soil is made up of alternate layers of sand and silt, low in soluble salt and rich in lime and nitrogen. Soil survey of the Gandikota Project was conducted for the Public Works Department. The soils contained high percentage of sodium salts with high pH and the irrigation waters also showed a high percentage of injurious salts. Extreme caution was therefore advised in the introduction of irrigation in that area. Soil survey of five centres in the Ceded districts was conducted to examine their suitability for fruit cultivation. Suitable areas possessing soil depth, good drainage and favourable physical properties were selected and advice tendered to confine fruit cultivation to these areas only. In 1945 an unusual cyclone struck the Circars' Coast and the tidal wave inundated the paddy areas all along the coast making them saline. A soil survey was immediately undertaken to ascertain the extent of damage to the soil. It was found that the amount of salts retained varied with soil texture. The soils were fortunately free from sodium carbonate. A popular account of the investigations was published for the benefit of the ryots in the cyclone affected area with suitable recommendations. Examination of Vaippar area in the Tirunelveli district showed it to be unsuitable for cultivation on account of the highly brackish nature of the underground water. Experiments for the reclamation of alkaline areas in the Pattukottai area irrigated by the Cauvery-Mettur Canal have been laid to find cheap, suitable and quick methods of reclamation. In connexion with the intensive Firka Development Scheme alkaline patches were inspected, soils analysed and recommendations made for reclamation.

89. *Soil chemistry and manures.*—Useful information has been collected from the study of the characteristics of black, red and laterite soil types. Studies on soil phosphate has shown that phosphate fixation is controlled by absorption in the case of red soils and by precipitation in the case of black soils. This study will ultimately help to evolve recommendations about the most suitable method for applying phosphatic manures to different soils. pH determinations at the root zone conducted in paddy soils under different manurial treatments throughout one season for recording

seasonal and diurinal variations showed little variation in values. The results of the permanent manurial experiments on cereals showed that for maximum crop production either cattle manure or a mixture of NPK is desirable. NP also gives equally good results. Potasic manures are therefore not necessary for cereal crops. Experiments to study " in situ " the extent of decomposition of green manure (10,000 lb. per acre) in irrigated versus unirrigated and fallow versus cropped conditions has been in progress at Siruguppa for eight years. The results show a reduction in C : N ratio of the treated soils, and increase up to 20 per cent of total N in the irrigated plots receiving green manure and accumulation of more organic matter in the fallow irrigated plots. Based on these results, the second stage of field experiment and cropping to evolve a suitable rotation for the new Tungabhadra area have been laid out. Investigations on the relative merits of green leaf obtained from outside are in progress. It is found that the soils of the green manure plots have higher N contents than no-manure plot. The crop yields are found to increase with the N content of the manure, the order being dhaincha, pillipesara, sunnhemp and cow-peas.

90. Another set of field experiments to study how green manure crops help to increase the yield of paddy is also in progress. The results so far analysed show that (i) the total microbial population of the soil increases during the growth of the crop, (ii) the ammonifying organisms are most numerous in the green manure series, but no nitrate was detected in the drainage water, (iii) Nitrate reducing bacteria decreased in numbers both in the no-manure and " green " manure series, while they remained almost constant in the Ammonium sulphate treatment, and (iv) there was considerable reduction in the Ammoniacal N of the drainage waters with the growth of the crop, indicating that the Ammonia was either retained in the soil or directly utilized by the paddy crop. Green manuring for paddy is therefore strongly recommended for large-scale adoption choosing the crop most suited for each set of conditions. Studies to ascertain the chemical basis for the resistance of some paddy varieties to blast showed that the leaves of the resistant varieties are more extensively silicated than the leaves of the susceptible varieties. In general silication of the leaf increases with the age of the leaf, but decreases again during decadence. The degree of resistance varies with the silica content per unit area of leaf. This study will be very helpful to the breeder to reject susceptible varieties by laboratory examinations without waiting for the chance of natural infection of the crop and thus expedite the evolution of resistant strains. Recently, an investigation to study the amount of plant food removed from the soil by improved strains of different crops, compared to unselected bulk, has been initiated. Laboratory work has shown the possibility of utilizing sweet potato flour for biscuits and bread-making by blending with other flours. Analysis of sprouted and unsprouted sweet potatoes in storage, did not show any difference between the two in their food values. At the instance of the Marketing Adviser to the Government of India, a chemical and micro-biological study of the chewing tobacco from Jaffna

and Meenampalayam was instituted. It was found that for the production of the Jaffna tobacco of the quality that is in demand in Travancore, the crop has to be grown in on Jaffna soils alone. A five-year experiment initiated to ascertain the effect of irrigating sugarcane with saline water showed that nitrogen and chlorine contents of cane juice are high and that P_2O_5 is highest in pots irrigated with rain water unmanured. The absorption of phosphates thus appears to be impeded by salinity.

To improve the fertility level of marginal lands in the Province, experiments have been laid in the Agricultural Research Station, Koilpatti, and in the neighbouring ryots' land to grow a leguminous crop with phosphates and ploughing the legume crop to supply plant food and organic matter to the succeeding crop.

The Plant Physiologist commenced his work two years back and has taken up investigations on vernalisation, presoaking of seeds with chemicals, and effect of trace elements on the final yield of crops.

91. *Microbiology.*—Pure and efficient cultures of root nodule organisms specific to various legumes were isolated and are being supplied to ryots for field-scale inoculation of legume seeds to increase their yield. Experiments to ascertain suitable proportions for growing legumes and cereals for getting the maximum economic return have been laid out in collaboration with the Pulses Specialist. Studies on the microbial population and their activity in the various soil types in relation to irrigation, cultural operations and manurial treatments are being carried out. These experiments would ultimately furnish data as to the best treatment that should be adopted to increase the microflora in soil.

92. *Animal nutrition.*—This section has been carrying out studies on fodder grasses with respect to HCN contents, feeding trials with giant star grasses (*Cynodon Plectostachyum*), palatability trials with cumbu straw, malt refuse, as feed to dairy cattle and fluorosia studies in the Nellore district.. Further work on problems of animal nutrition has since been transferred to Animal Husbandry Department.

93. From the above, it will be seen that the Agricultural Chemistry section has been of considerable service to the public, other departments of Government and both cultivators and industrialists. The Committee therefore recommend that this section is kept at its high level of efficiency.

AGRICULTURAL METEOROLOGY.

94. The post of Agricultural Meteorologist was created in February 1948 and placed under the control of the Paddy Specialist. The association of this new section with an old section like that of the Paddy Specialist at present is not only intended for administrative convenience and technical guidance but also to secure a measure of co-operation between crop planning and weather conditions.

The number ad variety of observations on crops as required by the All-India Co-ordinated Crop Weather Scheme, which the staff at the Research stations have to record without any additional staff for this work, is found to be a strain on them. It is worth considering whether the observations could not be curtailed or additional staff provided for the purpose.

AGRICULTURAL ENGINEERING.

95. The Agricultural Research Engineering section was started in 1928 with the following objects: To conduct exhaustive tests on imported agricultural implements and to find out their suitability to the soil and farming conditions of this Province; to effect minor modifications or improvements in the same where necessary; to encourage local manufacturers of the modified implements, and to popularize such implements among the ryots of the Province.

96. The section is at present under the charge of a Research Engineer with one Gazetted and Upper Subordinate Assistant. The activities of this section have recently increased very considerably particularly during the war years and the subsequent " Grow More Food Campaign ". The following are some of the important activities in addition to research; maintaining a fleet of tractors with implements, bull-dozers and other agricultural machinery; distribution of the same to the ryots either on hire or outright sale; stocking and distributing pipes and other fittings required for crop irrigation; distribution of oil-engines and pumpsets on hire or sale. Carrying out repairs of agricultural implements and machinery belonging to the various sections at the Agricultural College and Research Institute; imparting instructions in Agricultural Engineering (Mechanical and Electrical) to students of the B.Sc. (Ag.) class; and distribution of iron and steel materials for local manufacturers of agricultural implements at controlled rates gathering the finished implements and selling them to the agriculturists through departmental depots (vide Appendix V).

97. During the period under review, the following new designs were made at the workshops in addition to further improvements to implements previously designed :—

(*a*) *Ploughs.*—A new plough intermediate between Cooper No. 11 and the Victory plough with an adjustable high-carbon-bar-point share and inclined landslide to combine increased life characteristic of the bar point together with the low drought of the Victory plough was designed.

(*b*) *Bund-former.*—Due to the acute shortage of steel in 1944 a wooden bund former with blade ends tipped with steel was designed. This had temporary use till the iron position became easier.

(*c*) *Butter-churn.*—A hand-operated centrifugal butter churn with bevel-gear drive was built for domestic purposes and was put to test. With minor alterations, the same was tested successfully with electric drive as well. This awaits taking up by the manufacturers.

(*d*) *Stirrup pumps.*—One thousand six-hundred and seventy-nine A.R.P. stirrup pumps were acquired. Between 1945 and 1947 the number of nozzles purchased amounted to 1,047. Subsequently 579 nozzles were purchased making a total of 1,626. These were distributed to the Agricultural Demonstrators.

(*e*) *Drying chamber for paddy.*—At the instance of the Industries Department trials made at the workshops showed that in drying chamber, for par-boiled rice, a temperature of 100°C to 120°C is the most suitable and that flue gases could be used directly.

(*f*) *Shanti multi-purpose implement.*—This implement designed in 1948 provides a number of useful attachments to a plough with the aid of which the plough can be used for digging, harrowing and hoeing. The set can be easily manufactured by a skilled village blacksmith and its performance compared very favourably with that of some of the more expensive implements.

(*g*) *Tilting bullock-cart.*—A tilting bullock-cart for transporting manure, sand, etc., and capable of being emptied without the animals being unhitched for tilting was designed and made. These are under further trials.

(*h*) *Wind-powered birds' scare-mill.*—A design of a bird-scaring device employing wind-power was worked out. An experimental model was made. This mill operates on very small wind velocities and the intensity of noise varies with the speed of the wind. Therefore, birds are not likely to get too familiar with the sound and disregard it. The present design of the sounding board is still under study for improvement.

Tests were conducted on the following machinery :—

Dania.—Threshing machine imported by the Indo-Danish Corporation is found quite suitable for threshing paddy, ragi, horse-gram and samai. A minor alteration had to be made to the concave to reduce the percentage of broken grain in the case of paddy. This machine is of the same type but with much less mechanical complication was made here and preliminary trials are encouraging.

A small size hand-operated baling press for straw, manufactured by a Calcutta Firm was bought in 1947 and put to extensive trials. Straw can be compressed to a quarter of its normal volume into bales of 100 lb. each. It takes six minutes to make one bale. It requires further investigation with a view to reduce operational costs.

A novel design of a hand-operated water lift manufactured from Calcutta was tested and proved unsuitable.

The new plough No. 15 designed by Messrs. P.S.G. & Sons' Charity Industrial Institute, Peelamedu, Coimbatore, was tested and the design approved for manufacture and distribution to ryots.

98. *Modifications and improvements of Agricultural machinery*—(i) *Orange grader.*—The existing design of the grader was suitably altered in 1948 to reduce its cost of production and bring it within the purchasing capacity of the small-scale fruit-grower. This improved model is made almost entirely of wood and costs only

Rs. 120. Its output is six thousand to eight thousand fruits per hour. During our visit to one of the grading stations at Koduru we found that the fruits from the delivery hole dropped rather abruptly. This abrupt fall is said to injure the fruits. The Research Engineer should look into this defect and rectify it.

(ii) *Potato grader.*—At the request of some of the leading ryots in the Nilgiris in 1945, the design of the orange grader, already in use, was suitably modified to enable potatoes also to be graded. The final design was sent to a local potato dehydrating factory for tests and the reports on its performance are satisfactory.

(iii) *Egg-grader.*—Reports received from several users of the egg-grading machine designed in this section, a few years back, indicated that the breakages to eggs resulting from the use of the machine amounted to as much as 10 per cent in some cases. The design was therefore modified and breakages have now been reduced to less than ½ per cent.

(iv) *Samai-dehusking machine.*—The design of the cotton seeds crusher was modified and adopted for dehusking samai which is cultivated in the Nilgiris and where it forms a staple article of diet. The modified design was sent to Ootacamund for demonstration. Grains dehusked in this machine are neither crushed nor powdered and the time taken is only half that required for dehusking by hand.

99. Distribution of small implements through departmental depots is another of the important function of the Research Engineer. Scrap iron and steel materials acquired from the railways were distributed at controlled prices to approved village blacksmiths, samples of their work were called for and tested and their entire production was distributed to ryots through departmental depots. As the iron supply was of a very high grade, the quality of the products was good and, in spite of the comparatively high cost, these implements were in very great demand. During the period under review, over 15,000 sickles, 16,000 hand-hoes and 6,000 plough-shares were distributed.

100. This section is hiring out tractors with attached implements to the ryots of the district for ploughing and bull-dozers for levelling and other reclamation work at concessional rates. The charges levied are Rs. 5 per acre for ploughing, Rs. 3 per acre for harrowing and Rs. 7 per hour for bull-dozing. The following table shows the progress during the period under review :—

Year.	*Area ploughed.*	*Area harrowed.*	*Area reclaimed and levelled.*
	ACS.	ACS.	ACS.
1944–45	1,011·00	100·00	..
1945–46	949·25	..	..
1946–47	847·25	130·00	853·75
1947 48	1,799·75	631·00	220·75

101. The agricultural machinery have a definite part to play in reducing costs of production and hence lowering of prices of agricultural products. Appendix VI gives the number of agricultural implements and machinery manufactured by the P.S.G. & Sons' Charity Industrial Institute under the guidance of the Agricultural Engineer and sold to the public.

102. The Committee feel that useful work is being done in the section and both the staff and workshop should be strengthened to make the section more useful to the agricultural public. At present, the designs evolved at the section are mainly used by the local P.S.G. & Sons' Charity Industrial Institute for manufacturing the implements. But these are often beyond the reach of the ordinary cultivator, because of the absence of competition. The Committee feel diffident to make costly recommendations but the expansion of the section in staff and the enlargement of the workshops should be kept in view as conditions improve.

AGRO-INDUSTRIES.

103. Various sections at the Institute have been carrying on research with the object of setting up plant industries and some of these have achieved success and advanced to pilot plant stage. Certain laboratory investigations in this direction are given below :—

Agar-Agar has been successfully prepared from sea-weed—Cracilaria Lichenoides—which is found in abundance on the south-east coast of India. The resultant product has been certified to confirm to B.P. standard.

Preparation of Cocoa.—Laboratory preparations made from cocoa pods obtained from Kallar gardens have shown satisfactory results and the products compare favourably with standard product like Van Houten.

Activated carbon.—Research on activated carbon to find an alternative to paddy husk, has shown that groundnut husk serves the purpose equally.

Peptones from groundnut.—Peptone preparations have successfully been made from groundnut resulting in a palatable tonic.

104. Agro-industries that are now on a semi-commerial or pilot stage include (i) manufacture of malt and malt products, (ii) production of food yeast plant, (iii) production of ergot and (iv) fruit canning and fruit preservation.

105. *The Malt Factory.*—Research for the manufacture of malt products from local grains like cholam was commenced during the World War I—1914–1918—with the object of producing in the country substitute food for the imported ones.

After series of experiments, the work reached a stage by 1943, when production of malt food from cholam on a semi-factory scale was started. This factory had many vicissitudes due to lack of machinery and most of them had to be improvised locally during the difficult war years.

The first product produced was a straight malt food without admixture of milk, sugar or flavouring substances. This proved a failure. The Malt Factory at the Institute has long been a losing concern, because the cholam grain is much less suitable than the world-famed barley for malting purposes. The factory is now making malt extract and putting out two products, namely, pure malt extract and malt extract suitably mixed with shark-liver oil. Neither of these products are easily saleable in the open market in competition with the imported malt food. The Committee see no future for the factory as a commercial proposition. It recommends that this factory be handed over to the Industries department or private manufacturing concern for further development of the results obtained.

106. *Production of Food-Yeast.*—The Institute is running a pilot plant for food-yeast production under the control of the Government Mycologist. The yeast is prepared from molasses and finds a ready sale on account of its high quality. The plant is paying for itself. Full commercial utility of such plants would, however, be in the vicinity of sugar factories, where molasses is easily and cheaply available. The attention of the existing sugar factories might be drawn to this important development for utilizing one of their main by-products.

107. *Production of Ergot.*—The production of ergot is in charge of an Assistant Mycologist stationed at Ootacamund under the control of the Government Mycologist, Coimbatore. The production of ergot by spraying the inoculam on rye infloresence in the Nilgiris has proved a great success. The world demand for ergot is very large and when its production in the country is widely known, there is sure to be a brisk demand for the product. The ergot produced has shown higher alkaloid contents than those produced in other countries and this has been secured by analysis and selection of sclerotia. There is little doubt that if properly developed this agro-industry will be useful to the country.

108. The Committee find that on each pound of ergot sold the Government are making a profit of Rs. 8. During the course of four years, when ergot production has been in operation, the department earned Rs. 81,222 against an expenditure of Rs. 82,727. The Committee feel that there is a great scope for expansion of ergot production even to meet the country's needs. The Committee understand that the cultivators on the Nilgiris are eager to grow rye as they make handsome profit. The Government should take advantage of this favourable position and introduce a system of registering growers of rye in the Nilgiris, to whom all technical help should be given.

109. *Fruit Canning and Preservation.*—The laboratory work at the Fruit Research Station, Koduru, in developing a suitable technique for fruit and vegetable canning and preparation and preservation of fruit juices and squashes has indicated the possibility of the establishment of a fruit industry in this country. It is well known that the South Indian diet is deficient in respect of fruits. The Committee consider that all encouragement should be given to the Koduru work to take it to the pilot plant stage. The Committee further recommend that another unit like the one at Koduru might be started in a more central place like Madras to attract prospective industrialists.

The Committee are glad to find that the Government has recently passed a Fruit Products Order and recommend that the same may be rigorously enforced. Besides the interesting and valuable work that is in progress on hill and other fruits, the Committee are strongly of opinion that work should be extended to common fruits and vegetables so as to make available to the common man quantities of these necessary additions to the South Indian diet at cheap prices.

110. The Committee appreciate the forward policy of the Provincial Government in encouraging such research and working the results to the pilot plant stage to enable private enterprise to utilize them.

AGRICULTURAL RESEARCH STATIONS.

111. A list of research stations, both departmental and temporary Commodity-Committee stations, and a list of research schemes in progress are given in Appendices VII and VIII. As this report has been drafted on crop basis, no detailed review of work of each station has been separately given. Their work has been included at appropriate places under the crops. All the same, the Committee make the following general observations on them. In some of the research stations, the area is not sufficient; in others, laboratory and, in most, library facilities are inadequate. The research workers in regional stations should be aware of the latest advances in knowledge and technique at least with reference to the crops the station is dealing with. This should be rectified at the earliest.

112. The Committee found that even in the station like the main Paddy Breeding Station, Coimbatore, and the Research Stations at Koilpatti, Aduthurai, Tindivanam, Samalkota and Anakapalli, where the electric power lines are passing adjacent to the stations and the neighbouring cultivators were receiving electric supply, the same was not available at the station itself for the needs of the farm or the residents. Again, for best results, the staff should live with the crop wherever possible. The staff at the research stations have expanded far beyond the early plan of the residences built. The staff now living outside the station have to make several trips to the station each day in connexion with

work. Private organizations like that of the planters have led the way by providing both houses and other amenities like electricity, water-supply, transport for getting the maximum work from their staff. The Committee recommend that these amenities should be provided.

113. Appendix IX gives the expenditure and receipts of agricultural research stations. It will be seen that the receipts are far less than the expenditure and the criticism is often made that these stations do not pay. In the very nature of things, research stations can never pay because of the large staff employed on research and expenditure on the several experiments in progress. Both these items would be unnecessary when the crop is grown on a business basis. If the economics of the recommended methods are to be demonstrated to the agricultural public in a practical and visual manner, a separate unit is needed. The Committee recommend, the opening of such regional demonstration units to satisfy the public as funds become available.

AGRICULTURAL RESEARCH IN THE PROVINCE.

114. *Research expenditure.*—The expenditure of the department for 1948–49 is Rs. 1,24,59,530 made up of the following main heads as against a receipt of nearly Rs. 8,00,000 :—

	RS.	
(i) Research experimental farms	14,35,354	
(ii) Agricultural Research Institute including research schemes financed by crop committees	10,88,770	
Total ..	25,24,124	or 25 lakhs.
(iii) Agricultural education including capital expenditure on the new Agricultural College at Bapatla	9,54,973	or 10 lakhs.
(iv) Direction, Superintendence and Demonstration	3,81,005 14,35,354 39,82,158	
Total ..	57,98,517	or 58 lakhs.
(v) Agricultural Engineering	36,36,324	or 36 lakhs.

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115. It will be seen that the expenditure on research in this Province is hardly one-fifth of the expenditure of the Agricultural department as a whole and works out roughly to one anna four pies on every acre of land cropped.

116. *Research Council.*—While conceding that the Research Council as constituted at present is of great use to co-ordinate research in the different sections, the Committee feel that the association of representative Deputy Directors of Agriculture is necessary when drawing up the three-year programmes to introduce a greater realism and place the schemes in proper priority

according to the district needs. The Committee recommend that the three-year programmes should be further whetted by a small outside advisory body consisting of retired officers of the department and leaders who are taking keen and continued interest in agricultural development. In the body of this report, we have made other recommendations to improve its efficiency.

117. The department of Agriculture is now helped in the work of trading schemes and Agricultural Engineering by a separate Joint Director of Agriculture. The Committee feel that, as research is of equal, if not of greater importance, to the work of the department, the present post of the Headquarters Deputy Director of Agriculture (Research) should be converted into Joint Director of Agriculture (Research). This officer will guide and co-ordinate research in the department, preside over the important meetings of the Research Council and act as convenor of the advisory body suggested in the preceding paragraph.

118. *Research Personnel—Status and Emoluments.*—Heads of sections at the Research Institute and Deputy Directors of Agriculture are promoted to this rank on account of their long experience and merit. In the discharge of their duties, they have to control other officers under them. At present, these posts carry a meagre allowance of Rs. 50 per month over the basic pay. The Committee recommend that a separate cadre be instituted for these officers comparable in pay and status to officers in the Engineering department like the Executive Engineers. Heads of sections and others in the department have won deserved encomiums from the All-India Commodity Committees. They, however, suffer from a lower status and amenities, as compared to similar officers of the Central and other Provincial Governments. The Committee feel confident that this will soon be rectified. Almost everywhere we found in the responsible officers of the department both enthusiasm and willingness to give their best to the work partly because of the nationalization of the Government. The Committee feel confident that the Government in its turn will encourage them in the interest of the Province and self-sufficiency in food.

119. *Disadvantages of frequent changes.*—Most of the officers, when the Committee met during discussions and tours, complained about the handicaps to their work, resulting from frequent transfers of staff without consultation of the controlling officers and the work at some of the stations showed the ill-effects. We saw this in an extreme form in the Pomological Station at Coonoor, where, at the time of our visit, none of the staff was of more than three months' stay at this station, which has been in existence for 29 years. In research work, continuity is a major factor for its success and change of staff results in the loss of the accumulated experience that had gathered round particular individuals. At present, one reason for these changes is said to be that the department finds itself unable to benefit a good worker according to his

deserts unless he be shifted elsewhere. Every worker should be made to feel in practice that if he continues to put forth his best, promotions would come at his place and in his own line of work.

In organizing and manning science section, care should be taken to see that the personnel is so distributed that every head of a section has understudies, who could take his place with confidence when necessary. It is only then that the output of research from the sections will be uniform in quality and of progressively rising values.

120. *A new source of researchers.*—The Madras Government is rightly spending fair amount of money on Agricultural development and research in the Province. The research is so continuous and the problems that crop up from time to time are so unbroken that however fully a section might have been manned at the start, the need for the number of researchers soon outstrips the provision first made. In the course of their work, the scientists are often confronted with problems, which, however interesting they might be, they have to give up owing to dearth of researchers. In such cases the addition of scholars who are keen on doing some original research such as the young hopefuls from the universities preparing for the M.Sc. or the Doctor degrees would be useful and handy. They are actually on the look-out for the research problems and are keen on building of their scientific career. The Madras University, for instance, institutes each year a few such studentships or fellowships but the number is inadequate. If the Provincial Government or the All-India Commodity Committees could institute these in larger numbers and with greater attractions to the researcher, it would give a great impetus to research in the Province. The return in the shape of research output will amply repay the expenditure involved. Yet another result that would follow from this arrangement will be the building up in the country of scientifically-trained man-power of which there is a paucity at present.

121. *Permanance of the Research staff.*—Appendix X gives particulars of permanent and temporary staff in the Agricultural department under the various category. It will be seen that bulk of the staff are on temporary basis. The temporary nature of the staff in agricultural research is partly due to their being borne on schemes financed by the Indian Council of Agricultural Research or other All-India Commodity Committees. While the Indian Council of Agricultural Research has undoubtedly helped to develop research in many directions, the temporary nature of the staff employed has been an inevitable evil. In the interest of research efficiency, it would be best to recruit staff on permanent basis and then lend them to the schemes as they come up.

122. *Lady staff in the department.*—The Government have rightly thrown open admission to the Agricultural College to lady students. This has naturally resulted in their getting into the staff of the different sections. We have had varying and in some

cases conflicting reports about the manner in which they have been found useful in the sections. Our educated ladies are yet in the transition stage between the West and the East in many respects and for the present the greatest benefit both to the department and the particular sex would be to confine them largely to places that do not need (i) heavy outdoor field work such as standing in puddled paddy fields in the hot sun, (ii) heavy outstation touring associated with certain types of work in the districts, or (iii) the rougher spheres of activity for which man is better suited. In this connexion it needs to be mentioned that the bulk of agricultural work in the fields is at present done by women, but the educated agricultural graduate is so different from the woman agricultural labourer that for some time to come it is best to confine lady staff to work which is largely of an indoor or laboratory nature. They are specially fitted to such work as dairying, work in the laboratories, the herbarium, poultry, horticulture and fruit preservation. In such spheres of work their well-known carefulness in detail, patience and perseverence would be an asset both to the department and to the lady staff.

REGIONAL CROP BREEDERS.

123. Practically every Breeding Station has already registered or will soon register a demand for increase in area and the demand is often based on sound reasons. Also there is an increasing demand for the creation of more crop specialists, the latest is that for pulses. Thirdly, there is rightly an increasing demand for regional stations to effectively carry on the breeding and testing work in the regions concerned. It is difficult to resist these demands. Obviously increase in the number of strains for multiplication and testing needs more area at the main stations and the creation of specialists' posts have led to greater and more channelised output of research in the crop concerned. As to Regional station, the environmental conditions vary so greatly from region to region that these stations are needed for successful breeding and testing under local conditions. But then is it not time to set a limit to this development in the interest of economy and the conservation of work and energy? In the case of pulses in particular we find that crop breeders engaged in other major crops like the cotton and millets have been able to produce types, which have been the first to go into cultivation to the advantage of the growers of these pulses.

124. The above experience indicates a line of useful development in crop-breeding in the future. The main crops are already having their specialists and the results fully warrant their creation. But the time would appear to have come when with regard to other crops of minor nature, a new method of approach to their breeding may be tried. Instead of specialists for minor crops, their breeding could well be entrusted to the already available breeders and future work on minor crops suitably distributed amongst them. The specialists working on a main crop like cotton and millets

have perforce to grow in rotation with his main crop, other crops and by suitably enlarging his assistant staff and area also if need be it should be possible for him to tackle the breeding of other crops with the least expenditure to Government. After all, the lines on which breeding has to proceed has been largely standardized and with suitable variations to fit into the added crop he should be able to do justice to it also. If need be some of the future breeders could be styled '*Regional Breeders*' so as to justify their new work but this is a matter of detail. The breeder himself will gain from the experience with another crop than the one he is mainly dealing with.

125. *Leased-land . for Temporary Sub-stations.*—Sub-stations which are concerned only with the testing and selection of types suited to definite regions may well be on leased land. It will save capital costs and also enable the work to be shifted to another place in the same region or to a different region should circumstances necessitate it. Suitable legislation will be needed for compulsory leasing of lands to the Agricultural department for short and definite periods.

126. *Relief to Scientific and Propaganda Staff.*—Both the heads of sections at Coimbatore and the district officers of all grades complained about the heavy administrative and accounts work which is their share preventing them from doing their legitimate work. We went into the agricultural depots on as many occasions as possible and obtained first-hand knowledge of the amount of work involved in connexion with the trading schemes now run by the Agricultural Demonstrators and District Agricultural Officers. We find that the agricultural demonstrator Agricultural Officers. We find that the Agricultural Demonstrator has no time for his agricultural work for which alone, he has been recruited and to which alone, he is inherently qualified. At each centre an Accounts officer, who would be able to take financial responsibility, is needed. We are reluctant to suggest the other alternative of handing over the trading schemes to the Industrial or Co-operative departments for two very good reasons, viz., (1) the possibility that by such transfer the articles may not reach the real agriculturist with whom the personnel of the Agricultural department alone is most familiar and (2) the present arrangement helps to bring closer together the staff of the department and the actual cultivators which is essential for sound agricultural development. By adding a little to the sale value of the articles stocked such as iron and manures, it may be possible to partly reimburse the extra expenditure thus detailed by this proposal. In the case of artificial manures and iron material, a small addition to the price may be made if by that means its sales would not get delimited. Such relief is important and urgent.

127. *Improving the efficiency of the District Staff.*—The closest link between the Agricultural department and the ryot

is through the agricultural demonstrator. During the tours we have often noticed this important place being filled by raw men with little farm or district experience. It is to be remembered that the agricultural demonstrator represents the department to the cultivator and if he is not of the right type, the whole prestige of the department is at stake and what is more important, the good that the department is expected to do to the cultivator will be curtailed. The organization of the department may be compared to a chain connecting the researchers with the growers, out in the district. It is obvious that the strength of this chain is equivalent to the strength of its weakest link. We have no hesitation in saying that at present the agricultural demonstrator is this link and weakest under the existing arrangements. This is because he is overburdened with work and responsibilities connected with Trading schemes.

128. Some of the regional sub-stations are directly under crop specialists and others are under the administrative control of Regional Deputy Directors of Agriculture—the Crop Specialists in such cases—acting as technical advisers. The Committee understands that these major regional sub-stations have recently been put in charge of temporary Superintendents (Gazetted), recruited from subordinates trained at crop breeding stations. The Committee feels that this is a step in the right direction to ensure continuity and efficiency of research in the regional stations. The Committee hopes that these temporary posts will soon be made permanent and this policy of placing the major research stations under Superintendents drafted from subordinates of merit, working in the crop breeding stations will be followed. The Agricultural Research stations are mainly manned by Research assistants of the respective crops. There are still a few stations, which are staffed by subordinates classed as Farm Managers. They are liable to be transferred to the district as agricultural demonstrators or as Farm Managers. Frequent transfers in this group of subordinates are reported and adversely affecting the continuity and efficiency of research. It is desirable that all the permanent staff of a Research station should be of the assistant group to prevent frequent transfers.

129. But this arrangement of manning all the posts of central and regional research stations with subordinates classed as research assistants would deny the agricultural subordinates the necessary experience of farming and personal touch with crops and agronomic practices. The Committee feels that the agricultural graduates during the first five-year period, should have at least two years' experience in an Agricultural Research Station before he can be put in charge of a taluk to get necessary experience to carry out the right type of demonstration and effective propaganda. The filling up of the very few posts that are now classed as Farm Managers in the District Farms by the agricultural demonstrators does not at present give all the agricultural demonstrators a chance to be a Farm Manager even after ten years' service. One effective way of ensuring, that every new subordinate gets a chance of

working in a district farm, for at least two years, would be the creation of supernumerary posts of agricultural demonstrators on a temporary basis and attach them to the Agricultural Research Stations. This was once done in the case of the Indian Agricultural Service with satisfactory results. These posts should be filled up in rotation by the agricultural demonstrators recruited each year. Graduates straight from the college posted for propaganda work often cut a sorry figure in the eyes of the agriculturists who have long years of experience behind them.

130. *Enforcing Adoption of Proven Agricultural Practices.*—There are certain well-proven practices that the department is now in a position to recommend for adoption on a wholesale and intensive basis for quick results. These recommendations also some times carry with them a certain amount of compulsion and it is time that the agricultural public put up with this element of compulsion in the interests of the country as a whole. One such is the compulsory sowing of green manure crops in parts of the deltaic tracts at the time the paddy is harvested. This has been proved by the department through experiments both in their farms and in the fields of the cultivators to be the cheapest and most efficient method for properly manuring the crop. This compulsory method should be immediately adopted over selected areas such as the firkas chosen for intensive development of which there is one in each district. The Government should meet this expenditure at least in the early years till the ryots adopt the practice voluntarily and treat this as part of research expenditure from which the Government does not seek immediate gains. As the success of the practice depends on its adoption wholesale over the areas, it would be risky to depend on individuals doing it.

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PURE SEED PRODUCTION, GOVERNMENT RESPONSIBILITY.

131. Another item in the same category is the maintenance of pure seed with regard to the more important crops and make them available to the ryots as they need them. In certain cases, the Government may be faced with a loss in these transactions but this again should be considered as part of the research expenditure as otherwise the research carried out would be of no benefit to the ryots. Just as no Government looks to the immediate gains from medical research as also in the case of agriculture. Ultimately it would be found that this is more remunerative and of more lasting benefit to the country than the huge sums that are now expanded on the import of foods from outside the country. In this connexion the utilization of temple lands wherever available, for the multiplication of pure seed for supply to ryots would entail the least expenditure to Government. This would be a suitable line for entrusting to retired agricultural officers and thus utilize their knowledge and experience to the advantage of crop growing.

ACKNOWLEDGMENT.

132 The Committee wish to record its indebtedness to the Principal and Heads of Sections at the Institute for placing at their disposal all relative records and other facilities.

133. *Tribute to District staff.*—The district tours had naturally to be rapid owing to the short time at the disposal of the Committee. The district staff spared no pains during the tours to place before the Committee all the important features of both research and propaganda work. This has enabled the Committee to gather during the period a complete picture of the departmental activities.

134. *Tribute to the Secretary.*—It is difficult for the Committee to adequately express its indebtedness to the Secretary, Sri C. R. Srinivasa Ayyangar, for the manner in which he was helpful to the Committee in all matters, such as, collecting and marshalling the needed data, arranging for meeting with the agriculturists of the Province, including the small farmer and placing at its disposal his vast scientific experience and knowledge. They unanimously feel that they could not have had a more suitable and willing officer to discharge the duties of Secretary.

(1) (Signed) G. S. Cheema,
(2) (,,) T. S. Venkataraman,
(3) (,,) J. C. Luthra,
Members of the Scientific Expert Committee.

(Signed) C. R. Srinivasan,
Secretary.

RESUME OF RECOMMENDATIONS.

Seed multiplication.

It is not advisable for the Department to put up the selling price of improved seed merely to make the seed distribution schemes self-supporting. The premium paid to the seed producers and extra price paid to part with it, as inducement, should be subsidized by Government and seed sold to ryots only at prevailing market rates. In some tracts, where cultivators are extremely poor, there must be a provision to exchange seed paddy with paddy kept for food.

Paddy.

2. The expansion of the Ambasamudram station to serve Ramnad and Mathurai and selection of a bigger site in Nellore for working on the second crop, intermediate season varieties and rotational crops with paddy should be taken up at an early date.

3. Small temporary sub-stations attached to a nearest major station to deal with special problem connected with deep water in Collair area, tank-fed upland area of Krishna and Godavari districts, the saline areas of central and Ramnad districts and semi-dry areas of North Visakhapatnam should also be started on leased land.

Millets.

4. At the central station at Coimbatore, the study of fundamental aspects of problems connected with Millets should continue. The evolution of improved strains of millets in Coimbatore for the neighbouring districts should be carried on.

5. The production of hybrid strains in Cumbu and production of cosmopolitan strains in millets should be intensified.

6. As regional sub-station breeding work is important, in millets, more small sub-stations should be opened.

Pulses.

7. Breeding work on pulses is best entrusted to crop breeders who have to grow them in rotation with their main crops.

Cotton.

8. The seed multiplication schemes in cotton should be directly controlled by the Assistant Cotton Specialists of the zone, up to ginning and bagging. The Cotton Control Act now before the Ministry should be passed at an early date to enforce the growing of cotton recommended for a particular region.

Oilseeds.

9. The posts of Superintendents at Nileshwar and Tindivanam should be made permanent.

10. The records of coconut stations as well as of all long duration crops like fruit trees should be written in indelible ink on parchment paper and filed in leather bound books and duplicated at the Headquarters of the Specialist.

Fruits.

11. The future improvement of fruit demands extension of hybridization work in all fruit crops. Facilities in the shape of extra land for progeny tests should be provided at Kodur for fruit work. District work on fruits should be entrusted to properly trained staff.

12. All horticultural work should be brought under one controlling officer.

13. Regional fruit research stations to tackle local problems are necessary.

Potato.

14. The present research station at Nanjanad should be raised to the status of a potato breeding station. It is necessary to intensify potato breeding work. The post of the Superintendent should be made permanent. The seed certification scheme should be brought into force.

Cardamom.

15. The cardamom scheme is recommended for continuance providing necessary amenities to staff on the same scale as is given by well organized hill planters.

Lecturing and Systamatic Botanist.

16. The activities of this Botanist should be confined to the collection of weeds and study of their life cycle and mode of spread, with the object of finding control measures.

17. In the matter of medicinal plants, this section should aim at getting the full co-operation of Indian Schools of Medicine and institution, like the Central Drug Institute at Lucknow.

Cyto-Gentics.

18. The section should be enlarged to cope with the demands from the crop breeders.

Botanical Gardens, Ootacamund and Coonoor.

19. Research in floriculture should be encouraged and selection, propagation and distribution of planting material of certain economic plants should be undertaken.

These gardens should be brought under the control of the proposed Horticultural Section.

Entomology.

20. The research on pests of paddy, biological control work and preparation of indegenous insecticides should be intensified. Attention should be paid to the manufacture of cheap dusting and spraying equipments locally.

Mycology.

21. The work on cereal rusts, virus and other diseases of crops and fruits should be intensified.

Agricultual Meteorology.

22. The work connected with the All India Co-ordinated crop weather scheme is putting a strain on the staff of research stations. Either this work should be curtailed or additional staff appointed immediately.

Agricultural Engineering.

23. Both staff and workshops should be strengthened to enable the Agricultural Engineer to expand his activities.

Agro-Industries.

24. Research work on agricultural products should be carried only to the pilot plant stage.

Agricultural Research Stations.

25. Sufficient area and adequate laboratory facilities should be provided wherever they do not exist. To get the best output from the staff, residences should be provided and where electric power is available, it should be extended to the stations.

26. Separate demonstration farms should be organized as funds permit to prove to the ryots the commercial value of recommended improvements.

Research Council.

27. Representative Deputy Directors should be made members of the Research Council. An Advisory Body consisting of retired agricultural officers and public leaders keen on agricultural improvement should be organized to advise on the research programmes of the department. A need has arisen for the addition of separate ministerial staff to the Research Council. The post of Joint Director of Research should be created in place of the present post of the Headquarters Deputy Director of Agriculture (Research).

Research personnel.

28. The scale of pay and status of the Heads of Sections and Regional Deputy Directors should be on a par with officers of

other Departments like the Engineering Department of the rank of Executive Engineers.

29. Frequent transfers of research workers should be avoided and heads of sections should have understudies to take their place when necessary.

A New Source of Researcher.

30. University students should be encouraged to undertake post-graduate studies in the departmental stations by providing suitable inducements.

31. All staff should be recruited on permanent basis and deputed for work in the Indian Council of Agricultural Research and other schemes.

Lady staff.

32. Lady graduates should be employed largely on work in poultry, horticulture, fruit preservation and laboratories.

Regional crop breeders.

33. Instead of appointing specialists for minor crops, the work could be entrusted to the already available breeders of major crops.

Leased land for temporary sub-stations.

34. Sub-stations, which are concerned with the testing and selection of types suited to definite regions may well be started on leased land.

Relief to Scientific and Propaganda staff.

35. The District and Research Officers should be given relief from scriptory work by providing more efficient staff to handle routine and accounts matters to enable them to devote more attention connected with trading schemes so that the agricultural officers can devote more time to technical work for which alone they are employed.

Improving the efficiency of district staff.

36. The Superintendents of major Research stations should be drafted from subordinates of merit working at the crop breeding stations. It is desirable that all the permanent staff of a research station should be of the assistant group to prevent frequent transfers and maintain continuity of research work.

37. The Agricultural graduates during the first period of five years' service should have at least two years' experience of farm work before he can be put in charge of a taluk. For this purpose, supernumerary posts of agricultural demonstrators on temporary basis should be created and attached to research stations.

38. Multiplication of pure improved seed should be taken up on temple lands utilizing, if necessary, suitable retired agricultural officers.

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APPENDIX I.

G.O. Ms. No. 919, FOOD AND AGRICULTURE, DATED 9TH SEPTEMBER 1949.

[Agriculture—Survey of research work done by the Agricultural Department—Constitution of an Expert Committee—Ordered.]

Read—the following papers :—

G.O. Ms. No. 4950, Development, dated 5th October 1948.

Letter from the Director of Agriculture, dated 29th January 1949, No. X-3, 1253/48, and dated 1st September 1949, No. X-2, 162/49.

ORDER :—*Ms. No. 919, Food and Agriculture, dated 9th September 1949.*

On a recommendation of the Retrenchment and Reorganization Committee the Government have decided that a Committee of Experts should be set up to review the progress of research work done in the Agricultural Department during the five years 1944–48 in order to assess the value of the results achieved so far in terms of practical application to agriculture and suggest further lines of work to be carried out in all branches, e.g., soil science, manures, crop breeding plant protection and development of agricultural industries. His Excellency the Governor of Madras accordingly directs that the following gentlemen will constitute the Committee :—

(1) Dr. G. S. Cheema, D.SC., I.A.S.,
Fruit Development Adviser to the Government of India (Retired) (*Chairman*).

(2) Dr. T. S. Venkataraman, D. SC.,
Sugarcane Expert to the Government of India (Retired), Thyagarayanagar, Madras.

(3) Dr. D. V. Bal, M.SC., PH. D.,
Director, Institute of Plant Industry, Indore.

(4) Dr. Jayachand Luthra,
Principal, Agricultural College, Benares Hindu University, Benares.

The Secretary of the Committee will be appointed later in consultation with the Chairman and the Director of Agriculture, Madras.

2. The Committee will first assemble at Coimbatore and decide its programme of work. The Committee may visit such of the Centres of work or Agricultural Research Stations in the Province that it may choose for inspecting the work in progress. The itinerary will be decided by the Committee after it meets. A provisional tour programme for the Committee framed by the Director of Agriculture is given in the annexure to this order.* The Director of Agriculture has reported that during the stay of the members at Coimbatore the members of the Committee will be accommodated at the Agricultural College, Rest House, and that facilities for boarding are also available there. The Director of Agriculture has also stated that at other places, the officers in charge of the Rest House

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* Not printed.

at Agricultural Research Stations will be requested to arrange for the boarding and lodging of members. The Director of Agriculture is requested to circularise at once to all concerned to afford necessary facilities during the Committee's tour and also circulate immediately an advance copy of the notes of work done at the various scientific sections and Agricultural Research Stations to the members direct. The Government desire, that the work should be started as early as possible during the current month and finished, if possible, within six weeks. The Committee will submit a report direct to Government about the results achieved by the Research Sections together with its recommendations for their reorganization and reorientation of their programme.

3. The members of the Committee other than Dr. Luthra will be entitled to draw an honorarium of Rs. 1,000 each (rupees one thousand only) for the whole term of the Committee's work. The Government will meet the pay and allowances of Dr. Luthra for the period he is employed on the Committee. He will also be eligible to draw an honorarium of Rs. 500 (rupees five hundred only) in addition to his pay. The cost of the tours of all the members will be borne by Government. The members will be allowed Travelling Allowance as per officers of Grade I, viz., Daily allowance Rs. 10–8–0 (plus 50 per cent increase while in Madras). Mileage annas 9 (plus 50 per cent increase while in Madras). Railway Fare—1½ First Class.

NOTE.—Daily allowance will be admissible to members for all days required to be devoted to Committee's work from the date of assembling at Coimbatore.

4. Sanction is accorded to the employment of the following staff under the Committee for a period not exceeding two months from the date of employment or till the necessity for the staff ceases to exist whichever is earlier—

(1) One Stenographer on Rs. 45—90 p.m. with a special pay of Rs. 35 p. m. for shorthand higher grade.

(2) Four peons on Rs. 18—25 p.m. each (one for each member).

The proposal of the Director of Agriculture to employ a lower division clerk on Rs. 45–90 p.m. for a period of about two weeks to assist the Secretary in clerical work is also approved.

5. The expenditure will be debited to "40. Agriculture". The Director of Agriculture is requested to make necessary provision of funds in the revised estimate for the additional expenditure involved. Pending provision of funds the Accountant-General is requested to admit the expenditure in audit.

APPENDIX II.

LIST OF SUPERIOR STAFF WORKING IN COTTON SECTION AND VARIOUS SCHEMES UNDER ADMINISTRATIVE CONTROL OF COTTON SPECIALIST.

Particulars of staff. (1)	*Cotton breeding station, Coimbatore.* (2)	*Mungari scheme, Adoni.* (3)	*Coconadas scheme, Narasaraopet.* (4)	*Long staple cotton scheme, Palur.* (5)	*Winter cambodia scheme, Coimbatore.* (6)	*Tinnies and Karunganni scheme, Koilpatti.* (7)	*Northerns scheme, Nandyal.* (8)	*Westerns scheme, Hagari.* (9)
Gazetted Officers	1/1	–/1	–/1	–/1	–/1	–/1	–/1	..
Upper Subordinates	8/–	..	–/2	–/2	–/7	2/3	2/2	2/3
Fieldmen	12/–	–/3	–/6	–/3	–/9	4/6	1/5	1/6
Upper Division Clerk	..	..	..	–/1	–/1	..	..	..
Lower Division Clerk	2/2	..	..	–/1	–/1	–/1	–/1	–/1
Laboratory Attender	1/–	..	..	..	–/1	..	2/–	2/–

NOTE.—Numerator indicates permanent staff. Denominator indicates temporary staff.

APPENDIX III.

STATEMENT OF PLANT PROTECTION OPERATIONS FROM JANUARY TO AUGUST 1949—PESTS ON CROPS.

Name of pest. (1)	*Crops.* (2)	*Place of occurrence.* (3)	*Method of control.* (4)	*Area treated.* (5)	*Quantity of insecticides used.* (6)
1. Army worm of paddy (*Spodoptera mauritia*).	Paddy	South Kanara, East and West Godavari.	Mechanical and BHC dust D. 02 5.	6,301 acres.	2½ tons.
2. Paddy grass-hopper (*Hieroglyphus banian*).	Do.	Malabar and Krishna	BHC dust	8,370 ,,	5½
3. Oxya velox	Do.	Nellore and Krishna	Do.	360 ,,	..
4. Rice bug (*Leptocerisa acuta*)	Do.	Malabar, Coimbatore, Tirunelveli and North Arcot.	Netting and BHC dust	124 ,,	..
5. Paddy jassid (*Nephotettix bipunctatus.*) 6. *Leptispa pygmoea*	Do.	Salem, South Arcot, Tirunelveli and Malabar.	Netting and DDT. spraying BHC and DDT dust.	293 ,,	..
7. *Tetroda histeroides*	Do.	Coimbatore, Salem and Tiruchirappalli.	BHC dust	70 ,,	..
8. Parnara mathias	Do.	Coimbatore	DDT dust	6 ,,	..
9. Rats (*Gunomys Kok*)	Do.	Krishna district	Zinc phosphate in food	20,000 ,,	·7 tons.
10. Rice case worm (*Nymphula depunctalis*).	Do.	Malabar, South Kanara, South Arcot and Krishna.	BHC dust	Small areas.	..
11. Surface grass hoppers (*Aelopus* sp. *Chrotogonus*).	Millets, Cumbu or Ragi.	Mathurai and Guntur	BHC dust	Do.	..
12. *Hieroglyphus neigrorepletus*	Cumbu	Cuddapah	BHC dust	1,867 acres.	..
13. Ortheris sp.	Do.	Ramnad	BHC dust	Small areas.	..
14. *Calocoris angustatus*	Cholam	Coimbatore	BHC dust	Do.	..

15. Cholam mite	Cholam	Coimbatore, Salem, Tirunelveli and Mathurai.	Sulphur dust	150 acres.	..
16. Aleurodids	Ragi	Mathurai	BHC dust	Small areas.	..
17. Epilachna	Brinjal	All districts	Calcium arsenate dust	160 acres.	..
18. Chillies thrips (*Scirto thrips dorsalis*).	Chillies	South Kanara, South Arcot, Mathurai, Tanjore, Ramnad and Tirunelveli.	Tobacco decoction	Small areas.	..
19. *Mango hopper* (*Idiocerus sp.*)	Mango	Salem, Malabar, Coimbatore, Tanjore, North and South Arcot, Ramnad and Tirunelveli.	Fish oil, resin soap, sulphur dust, DDT dust and spray.	2,000 trees.	..
20. Citrus leaf caterpillar	Citrus	Vellore	DDT dust and spray	825 ,,	..
21. Groundnut aphid	Groundnut.	Salem and Coimbatore	Tobacco decoction	200 acres.	..
22. Betelvine bug (*Disphinctus*)	Betelvine	....	BHC dust	20 ,,	..
23. Nephantis	Coconut	Godavari, South Kanara, North Arcot, Mathurai, Tanjore and Chingleput.	Parasites liberated	50 ,,	..
			Total	37,971 acres and 2,825 trees.	15 tons.

APPENDIX IV.

DISEASE ON CROPS.

Name of disease. (1)	*Crop.* (2)	*Place of occurrence.* (3)	*Method of control.* (4)	*Area treated.* (5)	*Quantity of insecticides used.* (6)
1. (*a*) Piricularia in the nurseries.	Paddy ..	Nellore, Chittoor and North Visakhapatnam.	Spraying the nurseries ..	250 acres.	½ ton.
(*b*) Piricularia	Do. ..	Tanjore, Tiruchirappalli and Mathurai.	Distribution of resistant varieties.	40,000 ,,	..
2. Foot rot	Do. ..	Coimbatore, Mathurai and South Arcot.	Seed treated with Agrosan.	4,000 ,,	420 lb.
3. Smut	Sorghum ..	Bellary, Anantapur, Cuddapah, Kurnool, Guntur, Nellore and Mathurai districts.	Seed treatment with sulphur	1,08,000 ,,	2 tons.
4. Smut	Sugarcane ..	Chittoor, North Arcot and Mangalore.	Eradication of smutted shoot	50 ,,	..
5. Fruit fall	Citrus ..	Wynad, Malabar	Spraying Bordeaux mixture	Bulk of the area sprayed by the owners and 100 acres by the department.	1 ton.
Mottle leaf	Do. ..	Chingleput, South Arcot, Salem, Tirunelveli, Coimbatore, Cuddapah, Malabar and South Kanara.	Spraying zinc sulphate ..	600 acres.	6½ tons.
6. Sugarcane	Red rot ..	South Kanara and Tiruchirappalli.	Selection of disease from setts and dipping in Bordeaux mixture.	120 ,,	..

7. Mahali	Arecanut	Malabar and South Kanara	Spraying Bordeaux mixture.	The entire area in the district is sprayed by the owners themselves.	700 tons
8. Panama	Plantain	Tiruchirappalli and Chittoor	Eradication of deceased plants.	5 acres.	..
9. Mildew	Grapevine	Mathurai and Salem	Three sprayings with Bordeaux mixture.	50 „	2 tons.
10. Fruit rot	Chillies	Guntur, Salem and Tirunelveli	Spraying with Bordeaux mixture.	40 „	..
11. Stem-bleeding	Coconut	Malabar, Salem, South and North Arcot.	Tree surgery	20 „	..
12. Alternaria blight	Onions	Cuddapah, Anantapur and Coimbatore.	Spraying Bordeaux mixture	25 „	2 cwt.
13. Leaf spot	Turmeric	Salem and Coimbatore	Application of Bordeaux mixture.	50 „	5 „
14. Alternaria blight	Potato	Nilgiris	Do.	12 „	1 „
		Total	153,322 acres and 712 tons 8 cwt. 420 lb.		

Besides these numerous spraying demonstrations on small scales were carried out throughout the Province by the Special Plant Protection Staff in connexion with the control of diseases in vegetables and food crops.

APPENDIX V.

STATEMENT SHOWING LIST OF PLOUGHS AND IMPLEMENTS SOLD BY THE DISTRICT AGRICULTURAL OFFICERS.

Name of district.	1944–45.				1945–46.				1946–47.				1947–48.				1948–49.			
	NOS.	RS.	A.	P.	NOS.	RS.		P.	NOS.	RS.	A.	P.	NOS.	RS.	A.	P.	NOS.	RS.	A.	P.
Salem	200	456	4	0	12,581	15,448	3	8	2,943	5,741	3	6	10,083	18,987	4	9	16,078	42,510	2	11
Kozhikode	499	956	0	0	592	1,078	6	9	3,814	5,070	0	0	3,670	5,446	11	10	4,545	9,495	0	0
Tanjore	50,963	12,689	14	8	41,077	38,098	9	7	14,763	23,924	9	9	13,278	21,993	7	5	18,364	39,508	15	3
Chingleput	345	1,285	12	0	1,943	3,528	0	0	8,845	19,457	0	6	23,718	47,287	8	9	40,322	83,393	10	2
Cuddapah	229	560	0	0	2,033	5,638	10	8	2,316	6,729	1	1	11,926	22,241	3	1	18,981	36,085	7	9
Mangalore	748	1,519	0	0	3,599	7,586	0	0	4,672	7,697	0	0	14,980	31,354	0	0	5,192	12,810	0	0
Kakinada	106	265	12	0	326	1,356	6	0	1,577	2,820	3	0	1,950	4,058	2	9	7,173	17,107	9	0
Mathurai	..	..			10	81	0	0	77	7,901	0	0	170	2,552	0	0	318	1,986	0	0
Anakapalle	310	328	0	0	96	2,240	0	0	27	6,502	6	6	..	..			191	7,243	14	0
Ramnad	280	..			281	..			216	..			89	..			125	..		
Guntur	38	72	10	6	1,950	5,463	8	0	7,428	14,645	12	0	11,115	23,619	6	0	19,404	47,960	4	0
Cuddalore	..	..			..	..			20,429	..			28,831	..			30,349	..		
Nellore	..	..			6	120	0	0	5,764	17,592	0	0	5,615	16,845	0	0	..	..		
Araku Valley ..	..	..			..	..			..	..			..	..			..	..		

APPENDIX VII.

STATEMENT OF SALES OF "P.S.G." PLOUGHS AND AGRICULTURAL IMPLEMENTS EFFECTED TO THE VARIOUS RYOTS AND AGRICULTURAL DEPARTMENTS.

	Particulars.	*During the years.*		
		1944–45.	1945–46.	1947–48.
1	Ploughs	1,481	859	1,924
2	Mhote wheels	935	1,058	1,432
3	Ridge Ploughs	32	52	116
4	Wetland Puddlers	39	1	47
5	Green Manure Tramplers	33	3	17
6	Bund Formers	139	58	69
7	Guntakas	12	54	39
8	Buckscrapers	5	1	8
9	Cultivators	15	71	5
10	Chaff Cutters	19	26	34
11	Triangular Peg tooth Harrows	10	3	..
12	Cast Iron, Iron Bars	59	..	..
13	Cotton Stalk Pullers	2	1	..
14	Winnowing Machines	12	6	18
15	Seed Drills	10	11	3
16.	Sugarcane Crushers—Bullock driven type	23	67	55
17	Do. —Belt power type	8	1	19
18	Do. —No. 12 Horizontal type.	2	11	21
19	Turmeric polishers	1	3	..
20	Decorticators	..	2	..

APPEN

CROP AND AGRICULTURAL RESEARCH

Permanent.

Name of station.	*Officers in charge.*	*Controlling officers.*	*Major crops dealt with.*	*Year of starting.*
(1)	(2)	(3)	(4)	(5)
				CENTRAL AND
Sugarcane Research Station, Gudiyatam.	Farm Manager ..	Sugarcane Specialist, Anakapalle.	Sugarcane ..	1935.
Rice Research Station, Tirurkuppam.	Superintendent ..	Paddy Specialist, Coimbatore.	Paddy	1942.
Agricultural Research Station, Tindivanam.	Do. ..	Oilseeds Specialist, Coimbatore	Groundnut, Gingelly and Castor.	1933.
Agricultural Research Station, Palur.	Do. ..	Deputy Director of Agriculture, Tanjore.	Sugarcane, Paddy and Millets.	1912.
Agricultural Research Station, Aduthurai.	Do. ..	Do.	Paddy	1922.
Agricultural Research Station, Pattukkottai.	Farm Manager ..	Do.	Paddy mixed cropping.	1930.
Agricultural Research Station, Koilpatti.	Superintendent ..	Deputy Director of Agriculture, Mathurai.	Cotton and Millets.	1910.
				COIM
Central Farm, Coimbatore.	Superintendent, Lawley Road.	Principal, Agricultural College, Coimbatore.	....	1908.
Paddy Breeding Station, Coimbatore.	Paddy Specialist, Coimbatore.	Paddy Specialist, Coimbatore.	....	1915.
Cotton Breeding Station, Coimbatore.	Cotton Specialist, Coimbatore.	Cotton Specialist, Coimbatore.	....	1923.
Millet Breeding Station, Coimbatore.	Millet Specialist Coimbatore.	Millet Specialist Coimbatore.	....	1930.
Botanic Gardens and Orchard, Coimbatore.	Government Lecturing and Systematic Botanist, Coimbatore.	Government Lecturing and Systematic Botanist, Coimbatore.	....	1910.
				NIL
Agricultural Research Station, Nanjanad.	Superintendent ..	Deputy Director of Agriculture, Coimbatore	Potato	1917.
Fruit Station, Kallar and Burliar, Coonoor.	Assistant Fruit Specialist.	Fruit Specialist, Madras.	Hill fruits ..	1915.
Botanical Gardens, Ootacamund and Sim's Park, Coonoor.	Curator, Ootacamund.	Deputy Director of Agriculture, Coimbatore.	Ornamental gardening.	1900.
				WEST
Agricultural Research Station, Taliparamba.	Farm Manager ..	Deputy Director of Agriculture, Coimbatore.	Pepper mixed crop.	1905.
Agricultural Research Station, Nileshwar II and III.	Superintendent, Pillcode.	Oilseeds Specialist, Coimbatore.	Coconut	1916.

DIX VII.

STATIONS—MADRAS PROVINCE.

Temporary.

Name of scheme. (6)	*Officer in charge.* (7)	*Controlling officers.* (8)	*Committee financing the scheme.* (9)	*Year of starting.* (10)
SOUTHERN DISTRICTS.				
Sugarcane scheme, Gudiyattam.	Farm Manager ..	Sugarcane Specialist.	Indian Central Sugarcane Committee.	1935.
Tobacco Exploratory Station, Salem.	Do.	Deputy Director of Agriculture, Vellore.	Indian Central Tobacco Committee.	1948.
Tobacco Exploratory Station, Cuddalore.	Do. ..	Do.	Do.	1948.
Sugarcane Liaison Farm, Nellikuppam.	Superintendent ..	Sugarcane Specialist, Anakapalle.	Indian Central Sugarcane Committee.	1949.
Banana Research Station.	Assistant Fruit Specialist.	Fruit Specialist, Madras.	Indian Council of Agricultural Research.	
Ariyalur Millets Sub-station.	Assistant ..	Millet Specialist, CBE.	Provincial Scheme.	1949.
Karunganni Cotton Scheme, Koilpatti.	Superintendent ..	Cotton Specialist, Coimbatore.	Indian Central Cotton Committee.	1949.
Rice Research Station, Ambasamudram.	Assistant ..	Deputy Director of Agriculture, Mathurai.	Provincial Scheme.	
Tobacco Exploratory Station, Elayarampannai.	Do. ..	Do.	Indian Central Tobacco Committee.	1940.
Sugarcane Liaison Kulittalai.	Farm Superintendent.	Sugarcane Specialist.	Indian Central Sugarcane Committee.	
BATORE.				
Improvement of winter cambodia Cotton and Sea Island.	Superintendent ..	Cotton Specialist, Coimbatore.	Indian Central Cotton Committee.	1948.
Scheme for breeding Striga resistant Strains.	....	Millets Specialist.	Indian Council of Agricultural Research.	1949.
Cumbu Hybrid Scheme.	....	Do.	Do.	
GIRIS.				
Icarya Scheme ..	Assistant Entomologist.	Government Entomologist.	Indian Council of Agricultural Research.	
Ergot Scheme ..	Assistant Mycologist, Ootacamund.	Government Mycologist.	Provincial Scheme.	
....	....	....	....	
COAST.				
Sea Island Cotton trial—Pattambi, Nileshwar and Mangalore.	....	....	Indian Central Coconut Committee.	1948.

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APPENDIX—

CROP AND AGRICULTURAL RESEARCH

Permanent.

Name of station. (1)	Officers in charge. (2)	Controlling officers. (3)	Major crops dealt with. (4)	Year of starting. (5)
				WEST COAST
Paddy Breeding Station, Mangalore.	Assistant ..	Paddy Specialist.	Rice	1944.
Ambalavayal Farm, Wynaad.	Superintendent ..	Deputy Director of Agriculture, Coimbatore.	Fruits mixed cropping.	1945.
Agricultural Research Station, Pattambi.	Assistant Paddy Specialist.	Paddy Specialist.	Paddy	1936.
				NORTHERN
Agricultural Farm, Arakuvalley.	Special District Agricultural Officer.	Deputy Director of Agriculture, Visakhapatnam.	Mixed	1946.
Sugarcane, Research Station, Anakapalle.	Superintendent ..	Sugarcane Specialist.	Sugarcane, Millets and Paddy.	1913 extended in 1927.
Agricultural Research Station, Samalkot.	Do.	Deputy Director of Agriculture, Ellore.	Paddy, Sugarcane and Plantain.	1902, 1913–14.
Agricultural Research Station, Maruteru.	Do.	Paddy Specialist, Coimbatore.	Paddy	July 1925.
Agricultural Research Station, Lam. ..	Farm Manager ..	Deputy Director of Agriculture, Guntur.	Mixed cropping rainfed.	May 1922.
Agricultural Research Station, Nandyal.	Do. ..	Do.	Dry Cotton and Millets.	1906–1911.
				CEDED
Agricultural Research Station, Siruguppa.	Agronomist, Siruguppa.	Deputy Director of Agriculture, Bellary.	Irrigation and Agronomic studies.	August 1937.
Agricultural Research Station, Hagari.	Superintendent ..	Deputy Director of Agriculture, Cuddapah.	Cotton and Millets.	1907-08, 1910-11
Fruit Research Station, Kodur (Cuddapah district).	Do. ..	Fruit Specialist, Madras.	Fruits	1935.
Agricultural Demonstration Farm, Kalahasti.	Farm Manager ..	Do.	Mixed vegetable seed, multiplication.	1923.

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VII—*cont.*

STATION—MADRAS PROVINCE—*cont.*

Temporary.				
Name of scheme.	*Officer in charge.*	*Controlling officers.*	*Committee financing the scheme.*	*Year of starting.*
(6)	(7)	(8)	(9)	(10)
—cont.				
CIRCARS.				
Sugarcane Research Scheme, Anakapalle.	Superintendent ..	Sugarcane Specialist.	Indian Central Sugarcane Committee.	1947.
Yellamanchalli Tobacco Exploratory Station.	Farm Manager ..	Agricultural Demonstrator, Visakhapatnam.	Indian Central Tobacco Committee.	1948.
Narasapatam Millet Sub-station.	Assistant.. ..	Millet Specialist, Coimbatore.	Provincial Scheme.	1949 sanctioned but not started.
Sugarcane Liaison Farm, Samalkot.	Superintendent ..	Sugarcane Specialist.	Indian Central Sugarcane Committee.	1949.
Cocanada Cotton Scheme.	Assistant Cotton Specialist, Narasaraopet.	....	Indian Central Cotton Committee.	....
Chilli Scheme, Lam.	Do.	Cotton Specialist and Deputy Director of Agriculture.	Indian Council of Agricultural Research.	1949.
Ongole Millet Scheme.	Assistant ..	Millet Specialist, Coimbatore.	Provincial Scheme.	1949.
College Farm, Machavaram, Bapatla.	Senior Lecturer in Agriculture.	Principal ..	Temporary Farm.	1945.
Rice Research Station, Buchireddipalem.	Assistant ..	Deputy Director of Agriculture, Guntur.	Provincial scheme.	1937.
Northern Cotton Scheme, Nandyal.	Assistant Cotton Specialist.	Cotton Specialist, Coimbatore.	Indian Central Cotton Committee.	1949.
Tobacco Explanatory Station, Nandyal.	Farm Manager ..	Deputy Director of Agriculture, Guntur.	Indian Central Tobacco Committee.	1948.
DISTRICTS.				
Adoni Mungari Scheme.	Assistant Cotton Specialist.	Cotton Specialist, Coimbatore.	Indian Central Cotton Committee.	....
Western Cotton Scheme, Hagari.	Do.	Do.	Do.	1949.
Sugarcane Liaison Farm, Hospet.	Superintendent ..	Sugarcane Specialist.	Indian Central Sugarcane Committee.	1949.

APPENDIX VIII.

LIST OF SPECIAL AGRICULTURAL SCHEMES IN PROGRESS IN THE PROVINCE.

Serial number and name of scheme. (1)	*Place of work.* (2)	*Controlling officer.* (3)	*Object of the scheme.* (4)
	(*a*) SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH.		
1 Fruit Research Scheme ..	Kodur (Cuddapah district).	Fruit Specialist, Madras ..	Horticultural improvements of fruits such as mangoes, sapotas, with special reference to the classification of local types and problems of propagation, manuring and irrigation. Improvement of this fruit industry of the plains by undertaking research on the more important commercial fruit crops particularly mango and citrus.
2 Scheme of research on groundnut for multiplication of improved strains.	Agricultural Research Station, Tindivanam (South Arcot).	Superintendent, Agricultural Research Station, Tindivanam.	Isolation of pure lines for high soil contents, high shelling percentage and low free fatty acids content, production of varieties with short, intermediate and long duration, evolution of drought resistant varieties, study of inheritance of economic characters and study of manurial and water requirements.
3 Pulses Research Scheme ..	Coimbatore, Salem and Visakhapatnam districts.	Pulses Specialist, Coimbatore.	Isolation of high-yielding strains resistant to diseases taking into consideration points of interest like bold size of grain, attractive colour, cooking quality and flavour. The pulses dealt with are red gram, black gram, cowpea and lablab.
4 Scheme of research for the investigation of blast and foot-rot diseases of rice in Madras.	Coimbatore	Assistant Mycologist under the control of the Government Mycologist.	To investigate the blast disease of rice caused by the fungus *Piricularia oryzae* and foot-rot disease of rice caused by the fungus *Fusarium moniliforme var majus* with a view to devising suitable methods of control such as the utilisation of resistant varieties and the use of fungicides. Treatment in order to reduce the loss caused by those diseases in rice production.

5 Scheme for breeding on a large scale the predatory beetle, *Rodolia cardinalis*	Kodaikanal and the Nilgiris (Fernhill).	Government Entomologist ..	The scheme has for its object the breeding and liberation of the predatory beetle, *Rodolia cardinalis*. Muls., with a view to check the further spread of the fluted scale *Icerya purchasi*. Mask, and bring it under control in the Nilgiris and the Kodaikanal hills.
6 Scheme of Scientific aid to cardamom industry in South India.	Singampatti (Tirunelveli district).	Government Mycologist ..	Pests and diseases take a heavy toll of once flourishing cardamom industry in South India. The yield of cardamoms has consequently deteriorated from an average 100 lb. per acre to 35 lb. or less which make the cultivation of the crop unprofitable. The object of the scheme is to find out ways and means of controlling pests and diseases and restore yields to normal.
7 Pepper Research Scheme ..	Payyanoor of North Malabar district.	Pepper Specialist	To evolve higher yielding varieties of pepper to undertake research on control of insect pests and diseases and to work out the Agronomic problems connected with the pepper cultivation. NOTE.—The scheme though sanctioned has not been put into operation during the year under report.
8 Scheme for the improvement of chillies.	Guntur	Cotton Specialist, Coimbatore.	Breeding of a variety of chillies resistant to thrips and suitable to northern districts.
9 Opening of Banana Research Station at Aduthurai.	Aduthurai	Assistant Fruit Specialist under the control of Fruit Specialist.	To conduct research on Banana and to do breeding work for classification of banana varieties.
10 Scheme of research of orange borer in Wynaad.	Wynaad (North Malabar) ..	Government Entomologist ..	To study the causes of high mortality of orange trees in Wynaad.
11 Scheme for the investigation and control of orange disease in Wynaad.	Wynaad (North Malabar) ..	Government Mycologist ..	To investigate into the cause and incidence of orange disease.

Serial number and name of scheme. (1)	Place of work. (2)	Controlling officer. (3)	Object of the scheme. (4)
(b) SCHEME FINANCED WITH THE AID OF GRANTS BY THE INDIAN CENTRAL SUGARCANE COMMITTEE.			
1 Scheme of research on sugarcane borer pests Scheme of research on sugarcane pests and Trichogramma Colonization Scheme.	Coimbatore and Nellikuppam.	Government Entomologist ..	To tackle a number of items of research aiming at the study of the habits of important borers of the sugarcane crop at Coimbatore, the incidence of the weather on the borer population, their alternate host, host plant and natural enemies as well as the methods of control.
2 Sugarcane Research Scheme for the Madras Presidency at Anakapalle (Visakhapatnam district) and Gudiyatam (North Arcot district).	Anakapalle and Gudiyatam.	Sugarcane Specialist, Anakapalle.	Selection of high-yiedling and useful types of canes that suit the different conditions of soil and climate. Reduction in cost of production without detriment to high yields is also sought to be achieved.
(c) SCHEME FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE.			
1 Scheme for the improvement of Mungari cotton.	Adoni (Bellary district) ..	Assistant Cotton Specialist under the control of Cotton Specialist, Coimbatore.	Evolution of strains suitable to red soils of the Western Mungari tract and to replace inferior Mungari.
2 Scheme for the maintenance of nucleus of pure cotton seed.	Koilpatti, Coimbatore, Hagari, Nandyal and Palur.	District Agricultural Officer, Tirunelveli, Superintendent, Central Farm, Coimbatore and District Agricultural Officer, Kurnool and Cuddalore.	Maintenance of nucleus of pure seed of improved varieties of cotton Co.2 H1 and K-1.
3 Scheme for the improvement of Kakinada cotton.	Narasaraopet and Guruzala (Guntur district).	Assistant Cotton Specialist under the control of the Cotton Specialist, Coimbatore.	Improving the acre yield of Cocanadas and keeping at the same time the colour of the lint.

4	Scheme for long-staple cotton breeding.	Palur	Cotton Specialist, Coimbatore.	To evolve a long staple cotton suitable for cultivation in the East Godavari district under irrigation in summer.
5	Cambodia cotton scheme for Ceded districts.	Siruguppa (Bellary district).	Do.	To evolve a long staple cotton for the black soils of Bellary under irrigation.
6	Scheme for the multiplication, distribution and marketing. Co. 4 and B. 40.	Srivilliputtur	District Agricultural Officer, Ramnad at Sattur.	To multiply and distribute pure Co.4 B. 40 variety of cotton for the Srivilliputtur area.
7	Scheme for the improvement of Tirunelveli and Karunganni cotton.	Koilpatti (Tirunelveli district).	Assistant Cotton Specialist under the control of the Cotton Specialist, Coimbatore.	To evolve a cosmopolitan Karunganni type with high ginning percentage and staple length of the variety.
8	Scheme for the improvement of Westerns.	Hagari (Bellary district) ..	Assistant Cotton Specialist, Adoni under the control of Cotton Specialist, Coimbatore.	Improvement of Western cotton.
9	Scheme for the Marketing survey.	Throughout the Province ..	Provincial Marketing Officer, Madras.	To undertake a cotton survey in Madras Province as in Punjab.
10	Scheme for the breeding of long staple American cotton as a Winter crop in the Central Districts and Sea Island Cotton in the West Coast.	Tiruchengode, Srivilliputtur, Avanashi, Nileshwar, Pattambi and Coimbatore.	Cotton Specialist, Coimbatore.	To evolve a suitable strain of long staple American cotton and cultivating an inter crop in Central Districts and for conducting the trials of Sea Island varieties of cotton in West Coast of this Province.
11	Scheme for the multiplication of K-2 cotton.	Tirunelveli and Ramnad districts.	Do.	To run a combined seed multiplication and distribution scheme for Co-4 and K-2 Cotton.
12	Scheme for the improvement of White Northerns cotton in Madras Province.	Nandyal	Assistant Cotton Specialist.	To supply pure seeds to the cotton growers with a view to increase the staple length and spinning value of the cotton grown in this Province.

Serial number and name of scheme. (1)	*Place of work.* (2)	*Controlling officer.* (3)	*Object of the scheme.* (4)
(*d*) SCHEME FINANCED BY THE INDIAN CENTRAL COCONUT COMMITTEE.			
1 Coconut Nursery scheme in East Godavari and Tanjore districts.	Agricultural Research Station, Samalkot and Pattambi.	Oilseeds Specialist, Coimbatore.	To produce and supply good quality seedlings to the public on a large scale and at a cheap variety rate by starting Government coconut nurseries in the important coconut tracts of this Province. This is expected to eliminate the possibilities of the ryots planting inferior seedlings which would in the long run, result in low and uneconomic yields of coconuts.
2 Scheme of Research of coconuts.	Agricultural Research Station, Nileshwar.	Do.	Research scheme envisages the investigation of certain economic and practical problems connected with the coconut to establish criteria for the selection of seedlings that would ultimately give good yield to investigate into the causes of shedding of buttons (young nuts) in the coconut and to study the fibre obtained from coconut husks of different stages of maturity.
3 Scheme for raising coconut nurseries.	Agricultural Research Station, Samalkot, Anakapalle, Maruter, Aduthurai, Pattukottai, Pattambi, Nileshwar and Tindivanam.	Do.	To produce and distribute *Crotalaria striata* to the public of these districts.
(*e*) SCHEME FINANCED WITH THE AID OF THE GRANT OF INDIAN CENTRAL TOBACCO COMMITTEE.			
1 Scheme for opening of exploratory stations for tobacco.	Ellamanchilli, Nandyal, Sundarampatti, Cuddalore and Elayarampannai.	Deputy Directors of Agriculture.	To find out whether cigarette tobacco can be cultivated in this Province successfully.
2 Scheme for the production of 6,000 lb. of H.S. 9 tobacco seed.	Guntur district	Deputy Director of Agriculture, Guntur.	To produce 6,000 lb. of H.S. 9 tobacco seed for distribution.

(*f*) SCHEME FINANCED BY THE INDIAN OILSEEDS COMMITTEE.

1 Scheme for the economic survey of oil bearing plants and seeds in the Province.	Whole Province	Oilseeds Specialist, Coimbatore.	To survey the oil bearing plants and seeds in this Province and to survey the various commodities in all their aspects.

(*g*) GOVERNMENT OF MADRAS SCHEME.

1 Parasites for the control of black headed caterpillar pest (Nephantis serinopa) in East and West Godavari districts.	East and West Godavari districts.	Deputy Director of Agriculture, Eluru.	To control the leaf, eating caterpillar of coconuts.
2 Scheme for the investigation and control of black heart disease of potatoes.	Coimbatore	Government Agricultural Chemist, Coimbatore.	To control blackheart disease developed by potatoes during transit from the Nilgiris to consuming centres.
3 Experimental trials of economic plants and trees of exotic and local origin.	Anakapalle, Siruguppa, Aduthurai, Wynaad and Ootacamund.	Government Lecturing and Systematic Botanist, Coimbatore.	To select useful economic plants for propagation on a large scale. NOTE.—The experiment has been discontinued during the year in all places except at Anakapalle.
4 Co. 2 multiplication and distribution.	Tiruppur	District Agricultural Officer, Coimbatore.	To supply more seed of Co. 2 cotton for Coimbatore and Tiruchirappalli districts.
5 C. 11-2 or Co. 5 scheme ..	Udamalpet, Coimbatore district.	Do.	To supply pure seed for Co. 5 cotton for Coimbatore, Tiruchirappalli and Udamalpet.
6 Scheme for the evolution and multiplication of a strain of jonna for munagari season.	Siruguppa and Nandyal ..	Millet Specialist, Coimbatore.	To evolve a suitable munagari jonna for the Tungabhadra area.
7 Sugarcane Development Scheme.	Pugalore, Nellikuppam, Hospet and Samalkot.	Sugarcane Specialist, Anakapalle.	To increase the yield of sugarcane in the areas under the crop round about the sugar factory and in jaggery-producing areas.
8 Scheme for the improvement of sugar cultivation.	Aduthurai and Siruguppa ..	Do.	To select high yielding and useful types of canes and to determine the optimum manurial and cultural schedules of the tract.

Serial number and name of scheme.	*Place of work.*	*Controlling officer.*	*Object of the scheme.*
(1)	(2)	(3)	(4)
(*g*) GOVERNMENT OF MADRAS SCHEME—*cont.*			
9 Scheme for the chemical investigation of the cholam effect at the Agricultural Research Station, Koilpatti.	Agricultural Research Station, Koilpatti.	Government Agricultural Chemist, Coimbatore.	To conduct chemical investigation of soil samples and to ascertain the reasons for the adverse effect on fodder, cholam breeding on the dry cotton crops in southern districts.
10 Scheme for the opening new research stations for the production of improved strain of millet.	Ariyalur, Tirupathur, Ongole and Narasapatam.	Millet Specialist, Coimbatore.	To evolve new strains of improved millets which are resistant to pests and diseases and to supply high yielding strains of millets to millet-growing districts.
11 Scheme for the cultivation of jute in Madras Province on ryots' holdings.	Malabar, South Kanara and North Visakhapatnam.	Director of Agriculture, Madras.	To conduct exploratory trials on ryots' holdings to study the possibility of cultivating jute in South India.
12 Hingari Jonna Scheme ..	Siruguppa	Millet Specialist, Coimbatore.	For the multiplication of a cholam strain suitable for the Hingari season in Ceded districts.
13 Scheme for opening Demonstration Farms in 12 selected districts for perennial grasses.	Twelve districts	Director of Agriculture, Madras.	To demonstrate to the ryots the value of growing perennial fodder crops.
(*h*) SCHEMES PARTLY FINANCED BY GOVERNMENT OF INDIA, MINISTRY OF AGRICULTURE, NEW DELHI.			
1 Scheme for the multiplication of improved gingelly seeds.	Agricultural Research Station, Tindivanam.	Oilseeds Specialist, Coimbatore.	Multiplication of improved gingelly seeds and to increase production.
2 Scheme for the establishment of fruit farms at certain Agricultural Research Stations.	.... ..	Fruit Specialist, Madras ..	To develop fruit cultivation and fruit industry in the Province.

3 Scheme for the soil and water conservation by contour bunding.	Ceded districts	Assistant Agricultural Engineer, Bellary.	To prevent soil erosion and increase moisture content of the soil.
4 Scheme for the training of one Assistant Agricultural Engineer and three Supervisors at Central Tractor Organization, New Delhi.	....	....	....
5 Soil and water conservation by contour bunding in Visakhapatnam and Ceded districts.	Visakhapatnam and Ceded districts.	....	To consume rain water and to prevent soil erosion over 10,000 acres with dry farming area in Visakhapatnam and in Ceded districts.
6 Land development by mechanical cultivation and installation of pumpsets.	Throughout the Province ..	Joint Director of Agriculture, Madras.	To attend to tractor ploughing, technical assistance for sinking of wells, hiring and sale of pumping sets and other machinery to ryots, demonstration and spread of improved implements and mechanical.
7 Production and distribution of compost from town refuse.	....	....	To manufacture compost from night soil and rubbish and sell it to Co-operative Societies or direct to ryots or in public auction.
8 Rural compost making from waste vegetable matter.	....	....	To assist groups of ryots in rural areas to compost waste vegetable matter in common pits on a co-operative basis and to divide it among them for application to food crops.
9 State Trading Scheme for the purchase and sale of manures, seeds, iron and steel.	Throughout the Province ..	Joint Director of Agriculture, Madras.	To purchase large quantities of manures, improved seeds and iron and steel and distribute seeds and manures on subsidised basis and the iron and steel at cost price.
10 Popularisation of phosphatic manures.	Tanjore, Krishna, Guntur, East and West Godavari and Mathurai districts.	Director of Agriculture, Madras.	To demonstrate the use of phosphatic manures over 1,000 acres for bone meal and 400 acres for super phosphates in the six districts. *Note.*—The scheme has since been discontinued with effect from 31st March 1949.

Serial number and name of scheme. (1)	*Place of work.* (2)	*Controlling officer.* (3)	*Object of the scheme.* (4)
(*h*) SCHEMES PARTLY FINANCED BY GOVERNMENT OF INDIA, MINISTRY OF AGRICULTURE, NEW DELHI—*cont.*			
11 Comprehensive scheme for the multiplication and distribution of improved seeds of paddy, millets, pulses, groundnut and green manure seeds.	Throughout the Province. ..	Director of Agriculture, Madras.	To replace the impure varieties of crops by higher-yielding strains and thereby to increase the yield of food crops.
12 Control of pests and diseases of crops.	Do. ..	Do.	To purchase sprayers and fungicides and to supply them on loan to farmers.
13 Distribution of seeds and manures free of cost to poor and deserving ryots.	Do. ..	District Agricultural Officers.	To enable the poor ryots to liberally manure and sow seeds in their lands and thereby to increase the production of food crops. *Note.*—This scheme has been discontinued as ordered in G.O. Ms. No. 5717, Development, dated 19th November 1948.
14 Maintenance of reserve stock of paddy seed for emergencies.	Malabar district	District Agricultural Officer, Kakinada.	To serve as a reserve for emergencies like floods, cyclone, etc. *Note.*—This scheme has been discontinued.
15 Increasing production of vegetables.	Madras City	District Agricultural Officer, Thyagarayanagar, Madras.	To supply vegetables seeds to growers at cost price, to supply chemicals and fungicides and to give technical advice.
16 Free distribution of vegetable seeds to schools.	Throughout the Province ..	Director of Agriculture, Madras.	To supply vegetable seeds free of cost to schools for cultivation in school gardens.
17 Multiplication of seeds of improved vegetables.	Do. ..	Do.	To multiply English vegetables seeds and seedlings in an area of 90 acres at Wellington on the Nilgiris for distribution to farmers. *Note.*—The scheme has been discontinued from 31st March 1949.

18	Poultry development in Agricultural Research Stations.	Anakapalle, Samalkot, Palur, Aduthurai and Koilpatti.	Director of Agriculture, Madras.	To rear poultry in Agricultural Research Stations and supply eggs, chicks, and fowls to farmers.
19	Education of Farmers by special extension course.	All Districts	Do.	To take batches of enthusiastic farmers on tour to visit important Agricultural Regions and Government Agricultural Farms for widening their outlook on Agricultural improvements.
20	Manurial Experiments at the Agricultural Research Station, Nanjanad.	Nanjanad (The Nilgiris District).	Government Agricultural Chemist, Coimbatore.	To explain the possibilities of reducing the dosage of manures for growing potatoes in the Nilgiris district without impairing the yield or the productive capacity of the soil and thereby to reduce ryots manurial bill.

APPENDIX IX.

STATEMENT SHOWING EXPENDITURE AND RECEIPTS OF AGRICULTURAL STATIONS IN THE PROVINCE FOR THE YEAR 1948-49.

	Name of station.	*Total Expenditure.*			*Total Receipts.*		
		RS.	A.	P.	RS.	A.	P.
1	Agricultural Research Station, Samalkot ..	61,418	9	6	21,369	5	5
2	Cotton Breeding Station, Coimbatore ..	88,380	2	3	8,041	4	11
3	Agricultural Research Satation, Pattambi.	76,234	4	10	38,342	1	2
4	Fruit Research Scheme, Koduru	32,380	0	0	5,725	0	0
4A	Nursery Scheme, Koduru	11,804	0	0	6,238	0	0
5	Rice Research Station, Tirurkuppam ..	32,526	3	8	5,969	6	6
6	Paddy Breeding Station, Coimbatore ..	68,979	1	0	10,780	15	0
7	Paddy Breeding Station, Mangalore ..	41,646	7	0	6,871	4	6
8	Paddy Breeding Station, Ambasamudram.	15,035	14	0	9,167	1	11
9	Government Botanical Gardens, Ootacamund.	70,770	0	0	10,566	9	6
10	Agricultural Research Station, Tindivanam.	43,812	0	0	12,615	0	0
11	Agricultural Research Station, Nileshwar.	59,902	0	0	24,282	0	0
12	Millet Breeding Station, Coimbatore ..	59,729	0	0	6,302	0	0
13	Agricultural Research Station, Nanjanad.	59,000	0	0	34,500	0	0
14	Sugarcane Research Station, Gudiyatham.	29,974	0	0	14,932	0	0
15	Agricultural Farm, Arakku Valley ..	1,13,196	0	0	22,247	0	0
16	Agricultural Research Station, Maruter ..	57,323	10	10	16,676	0	0
17	Pomological Station, Coonoor	16,245	0	4	5,127	8	6
18	Fruit Station, Kallar	24,275	7	3	5,403	14	11
19	Fruit Station, Burliar	5,326	9	6	3,349	2	9
20	Agricultural Farm, Wynaad	76,055	9	5	11,716	9	7
21	Agricultural Research Station, Siruguppa.	76,762	0	0	7,399	0	0
22	Agricultural Research Station, Hagari ..	52,139	0	0	18,789	0	0
23	Agricultural Research Station, Pattukkottai	20,946	9	6	8,450	3	4
24	Agricultural Research Station, Koilpatti ..	58,147	9	9	13,108	11	11
25	Agricultural Research Station, Kalahasti ..	9,000	0	0	1,998	12	11
26	Agricultural Research Station, Taliparamba.	57,918	13	3	16,868	2	11
27	Sugarcane Research Station, Anakapalle ..	1,17,881	0	0	42,540	0	0
28	Agricultural Research Station, Palur ..	48,726	0	0	18,543	0	0
29	Agricultural Research Station, Guntur.* ..	28,685	15	0	1,509	8	6
30	Agricultural Research Station, Nandyal.*†	24,466	1	0	3,023	8	6
31	Central Farm, Coimbatore	1,83,814	0	0	20,765	0	0
32	College Farm, Machavaram, Bapatla* ..	56,517	0	0	8,410	11	9

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* Refers to 1946-47.

*† Refers to 1945-46.

APPENDIX X.

STRENGTH OF STAFF IN THE AGRICULTURAL DEPARTMENT DURING 1948-49.

Name of posts.	*Number of* Perma-nent.	*Tempo-rary.*	*Total.*
Gazetted officers—			
(*a*) At headquarters	3	12	15
(*b*) Marketing Section	4	3	7
(*c*) Officers on District work	27	11	38
(*d*) Officers in charge of Research Stations ..	2	12	14
(*e*) Agricultural College	5	24	29
(*f*) Research Section	19	41	60
Total ..	60	103	163
II. Non-gazetted—			
(*a*) Ministerial	148	1,274	1,422
(*b*) Madras Agricultural Subordinate service.	839	1,601	2,440
(*c*) Other services	44	42	86
(*d*) Inferior services	145	483	628
III. Engineering Section	..	1,141	1,141

GLOSSARY OF SCIENTIFIC NAMES.

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Common name.	*Scientific name.*
Acid lime	Citrus aurntifolia, Swingle.
Agave	Agave Sisalana, Perrine.
Alu bokaru (Guj.)	Prunus communis, Hunds., var. insititia.
Apple	Pyrus malus, L.
Arecanut	Areca catechu, L.
Avocadao	Persta americana, Mill.
Banana	Musa Paradisiaca, L.
Barley	Hordeum vulgare, L.
Bengalgram	Cicer arietinum, L.
Betel vine	Piper betle, L.
Billi-kichili	Citrus sp.
Blackgram	Phaseolus mungo, L.
Blast on paddy	Piricularia cryzae, Br. and Cav.
Bread fruit	Artocarpus incisa, L.
Bullock's heart	Anona reticulata, L.
Cabbage	Brassica oleracea, L., var. bullata D.C.
Cambodia Cotton	Gossypium hirsutum, L.
Cardamom	Elettaria cardamomum, Maton.
Carrot	Daucus carota, L.
Cashewnut	Anacardium occidentale, L.

Common name.	*Scirntific name.*
Castor	Ricinus Communis, L.
Cauliflower	Brassica Oleracea, L., Var., botritis, L.
Cheeni orange	Citrus sinensis, obbeck.
Cherimoyer	Anoacherimolia, Mill.
Chillies	Capscum anneum, L.
Cholam (Tam.)	Sorghum spp.
Cluster beans	cyamopsis totragonoloba, Taub.
Cocoa	Theobroma cacao, L.
Coconut	Cocos mucifera, L.
Cotton	Gossypium spp. see Cambodia Karunganni, Nadam, Pulichai and Uppam.
Cowpea	Vigna unguiculata, Walp.
Crab apple	Pyrus baccata, L.
Cumbu (Tam.)	Pennisetum typhoides, Stapf and Hubbard.
Custard apple	Anona reticulta, L.
Dhaincha	Sesbania bispincosa Fawcett and Rendle, pers.
Elephant grass	Pennisctum purpureum, Schum.
Fig	Ficus Carica, L.
Foot-rot of Paddy	Fusarium moniliforme, Sheld, var. Majus, Wr. and Rg.
Gajanimma (Tel.)	Citrus pennivesiculata, Tanaka.
Garlic	Allium sativum, L.
Gingelly	Seedmum oriotale, L.
Ginger	Zingiber officinale Bosc.
Crape vine	Vitis vinifera, L.
Greengram	Phaseolus sureous, Roxb.
Groundnut	Arachis hypogaea, L.
Guava	Psidium guajava, L.
Guinea grass	Panicum maximum, Jacq.,
Horsegram	Dolichosbiflorus, L.
Jack or Jak	Artocarpus integer, Merr.
Jamberi	Citrus Jambhiri, Lush.
Jasmine	Jasminum, spp.
Jonna (Tel.)	Same as Cholam.
Jujube	Zizyphus jujuba. Lam.
Karamani (Tam.)	Vigna unguiculata, Walp.
Karunganni cotton (Tam.)	Gossypium arborium var neglectum forma India (H. and G.).
Khatta	Citrus aurantium (L.) Tanaka.
Kichili	Citrus madraspatna, Tanaka clandestinum.
Kolakkattai (Tam.)	Grass Cenchrus ciliaris, L.
Kolinji (Tam.)	Tephrosia purpurea, Pers.
Kollaganjeru (Tel.)	Ipomoea hispida, Reem and Sch.
Korali	Sotaria pallidifusca, Stapf and Hubbard.
Korra (Tel.)	Seteria italica, Beauv.
Kumquat	Citrus Japonica, Thunb.
Lab-lab	Dolichos Lablab, L.
Ladies fingers	Hibiscus esculentus, L.
Lemon	Citrus limon, Burm. f.

Common name.	*Scientific name.*
Lime	Citrus aurantifolia (Christm Swingle).
Litchi	Litchi chinensis, Sonn.
Loquat	Eriobotrya japonica, Lindl.
Lucerne	Medicago sativa, L.
Lupin	Lupinus, spp.
Maize	Zea mays, L.
Mango	Mangifera indica, L.
Mangosteen	Garcinia mangostana, L.
Nadam cotton (Tam.)	Gossypium arboreum typicum (H. and G.)
Napier grass	Pennisetum purpureum, Schum.
Oats	Avena sativa, L.
Onion	Allium cepa, L.
Orange	Citrus cinensis, Osbeek.
Paddy	Cryza sativa, L.
Paddy, gall fly	Pachdiplosis oryzae, M.
Paddy, silvershoot	Pachydiplosis oryzae, M.
Paddy stem-borer	Schoenobius incertellus, W.
Palmyra	Borassus flabellifer, L.
Pamparapanas (Tel.)	Citrus paradisi, Macf.
Panivaragu (Tam.)	Panicum limiaceum, L.
Papaya	Carica papaya, L.
Passion fruit	Passiflora edulis, Sims.
Peach	Prunus Persica, Stokes.
Pear	Pyrus communis, L.
Peas	Pisum sativum, L.
Pepper	Piper nigrum, L.
Persimmon	Diospyros Kaki, L.
Phalsa	Grewia asiatica, L.
Pillipesara (Tel.)	Phaseolus trilobus, Ait.
Pine apple	Ananas comosus ,Merr.
Pink bollworm	Platyedra gossypiella, S.
Plantain	Musa paradisiaca, L.
Plum	Prunus domestica, L.
Pomegranate	Punica Granatum, L.
Pomelo	Citrus paradisi, Maef.
Potato	Solanum tuberosum, L.
Pulichai cotton (Tam.)	Arboreum Var. negleotum forma bengalensis (H. and G.).
Pummelo	Citrus grandis, Osbeek.
Ragi (Tam.)	Eleusine coracana, Gaertn.
Redgram	Cajanus cajan (L.) Millsp.
Rice	Oryza sativa, L.
Rice Bug.	Leptocorisa acuta, Th.
Rice caseworm	Nympula depunctalis, Gr.
Safflower	Carthamus tinctorius, L.
Sajja (Tel.)	Same as cumbu.
Samai (Tam)	Panicum miliare, Lam
Sepota	Achras sapota, L.
Seethaphal (Tel.)	Anona squamosa, L.

Common name.	*Scientific name.*
Soft rot of ginger	Pythium Butleri, Subrm.
Sour orange, country	Citrus aurantium war Bigardia Bnmp.
Sorghum	Sorghum spp.
Star apple	Chrysophyllum Cainito, L.
Strawberry	Fragaria vesca, L.
Sugarcane	Saccharum officinarum, L.
Sunnhemp	Crotalaria Juncea, L.
Sweet orange	Citrus cinensis, obbeek.
Tapioca	Manihot utilissima, Pohl.
Tenai (Tam.)	Same as Korra.
Thrips	Thrips oryzae, W.
Tobacco	Nicotiana Tabacum, L. and N. rustica, L.
Tomato	Lycopersicum esculentum, Mill.
Turmeric	Curcuma Longa, L.
Uppam cotton (Tam.)	Gossypium herbaceum L.
Varagu (Tam.)	Same as Arika.
Variga (Tel.)	Same as Panivaragu
Vasambu (Tam.)	Acorus calamus, L.
Vempali (Tel.)	Tephrosia purpurea, Pers.
Water melon	Citrullus vulgaris, Schrad.
Wattle	Acacia spp. (Australia).
Wheat	Triticum spp.

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